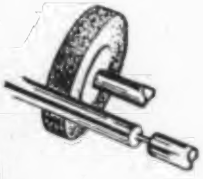
and Finishing

The Magazine Devoted Exclusively to Abrasive Operations

★ FEATURES



New Code: Key to Safe Grinding—Page 24

Grinding Aluminum—Page 28

Gear Shaft Grinding—Page 33

Big Barrels Speed Jet Output—Page 38

FEBRUARY, 1957

HONING • LAPPING MACHINES • ACCESSORIES • PORTABLE GRINDERS • TUMBLING • ABRASIVES

DETROIT PUBLIC LIBRARY
TECHNOLOGY DEPT
96 W PUTNAM AVE
DETROIT 2 MICH 73127

Heald **RED HEAD'S** extra precision and low maintenance

NOW AVAILABLE TO ALL USERS

of boring and internal grinding equipment

HEALD Red Head Boringheads and Wheelheads have achieved an enviable reputation for extreme precision and exceptionally low maintenance, on Heald Bore-Matics and Internal Grinders in use throughout the entire metalworking industry. Heretofore, they have been available only as original equipment or replacement items for specific Heald machines.

Now, however, in response to a continual and ever-increasing demand — and in line with the Heald policy of building standard machines and parts — it has been decided to market all standard Red Head Boringheads and Wheelheads without restriction wherever practical. This means that the extra precision and low maintenance provided by Heald Red Heads are now available to all users or manufacturers of metalworking equipment, regardless, in most cases, of the type of machines on which they will be used.

The standard head types and sizes that can be supplied are fully described and listed in the Bulletins noted below.

RED HEAD

HEALD

HEALD PERMANENTLY-LUBRICATED BORINGHEADS

Designed to provide high, sustained precision with virtually no maintenance, Heald Red Head Boringheads are permanently lubricated —no grease or oil is ever needed. They run cooler, reduce heat distortion and maintain high accuracy at all speeds and loads. Spindles run in precision bearings, specially manufactured to Heald specification and individually tested and selected for each head. Write for Bulletin 5-1, Issue 6.

HEALD HI-FREQUENCY WHEELHEADS

Providing proper speed for small-bore grinding, Heald Hi-Frequency Wheelheads deliver full power direct to wheel and eliminate drive upkeep costs. They can withstand momentary peaks of twice the continuous-duty rating. Those running over 30,000 rpm must be automatically lubricated by the Heald Oil-Mist system which also supplements effects of water cooling—others are permanently grease lubricated. Write for Bulletin 6-2, Issue 2.

HEALD PERMANENTLY-LUBRICATED WHEELHEADS

Heald Red Head Wheelheads incorporate the same high quality bearings and permanent, sealed-in lubrication as Heald Red Head Boringheads. They have repeatedly set the highest standards of accuracy, precision and surface finish. There are three general types: Quill Style, for a variety of work — Naked Style for high production on a single workpiece — Sleeve Style for large bores. Write for Bulletin 6-1, Issue 7.

IT PAYS TO COME TO HEALD

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

FEBRUARY, 1957—VOL. 2, NO. 10

Grinding and Finishing

Contents

Editor's Page 23

FEATURED ARTICLES

New Code: Key to Safe Grinding 24
Hi-Fi in the Grinding Room 27
Aluminum Grinding Techniques 28
Gear Shaft Grinding 33
by D. D. Baldwin
Developing Standard Time Data for Grinding Operations—Part 5 ... 35
by E. A. Cyrol
Big Barrels Speed Jet Output at Solar Aircraft 38
Grinding Safely 40
by Edmund Mottershead
A Yardstick for Automation 44
by George H. Amber and Paul S. Amber
Norton Unveils Alabama Electric Furnace Plant 66

DEPARTMENTS

Letters to the Editor 4
Industry Observer 12
Free Literature 57
What's New in Equipment and Materials 69
News of the Industry 82
District Managers 92
Index to Advertisers 94

EDITORIAL STAFF

William F. Schleicher, vice president and editorial director; ***Jack Kenyon,*** managing editor; ***Richard C. Bush,*** associate editor; ***Ronnie Burritt,*** consulting technical editor.

BUSINESS STAFF

R. C. Van Kampen, president; *Vincent C. Hogren,* executive vice president; *J. E. Hitchcock,* vice president; *Oliver S. Pepper,* business manager; *John S. Todd,* production manager; *L. M. Schroeder,* art director; *Robert L. Spreckels,* circulation manager.

Subscription rates: $6.00 per year in U.S.A. $7.50 per year elsewhere.

Copyright by Hitchcock Publishing Co., 1957, 222 East Willow Ave., Wheaton, Ill. Phone WHeaton 8-3400. Cable Address: HITCHPUB.

BPA

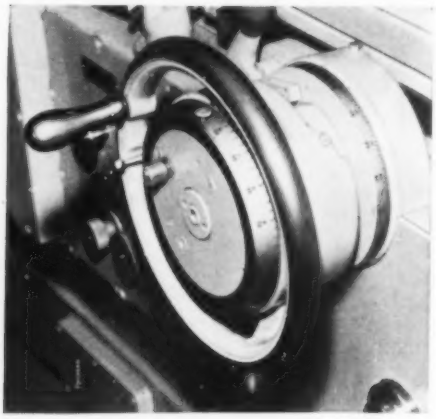
Accepted as controlled circulation publication at Pontiac, Illinois

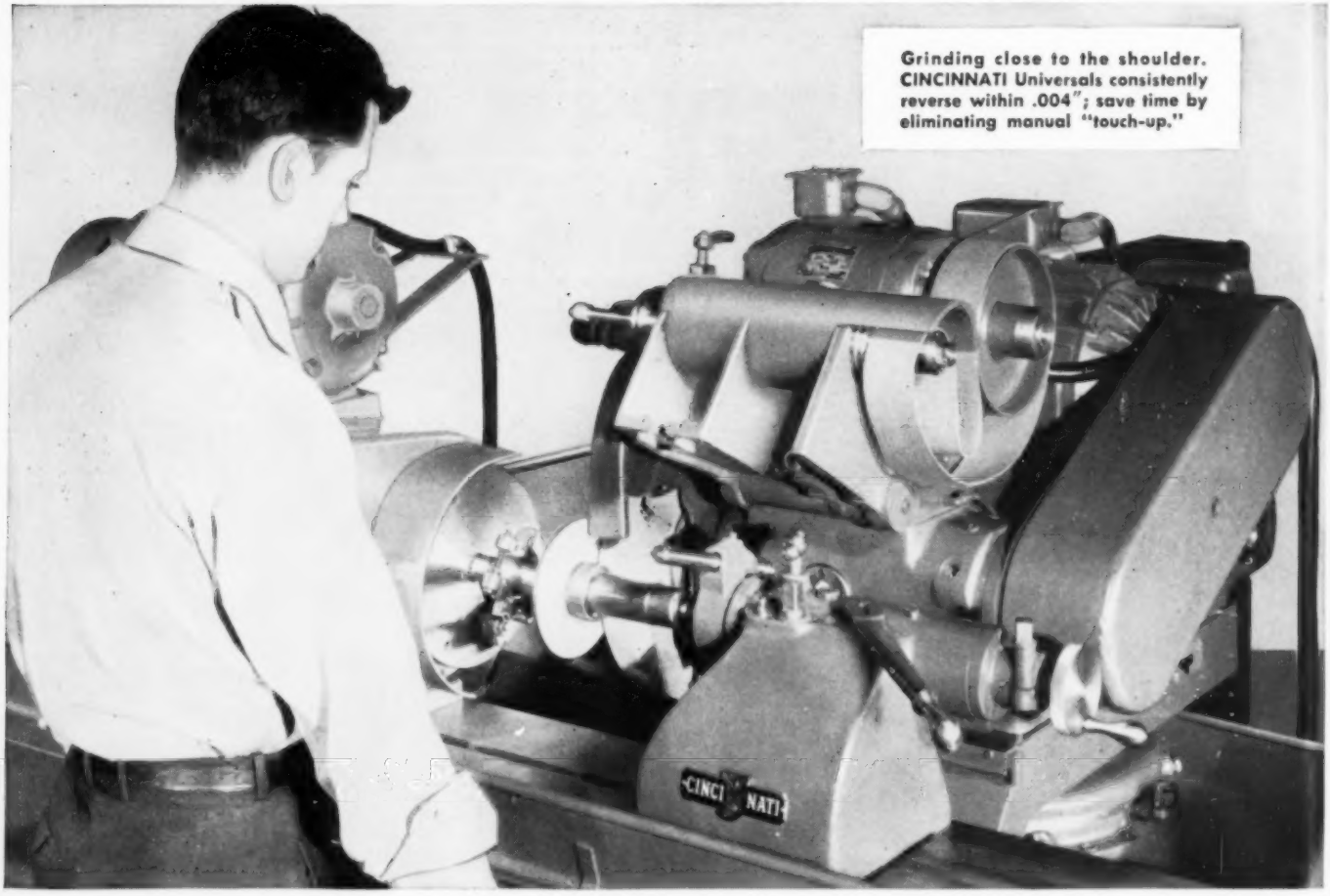
Cincinnati's setup timesavers . . .

reduce cost of your s

1

2





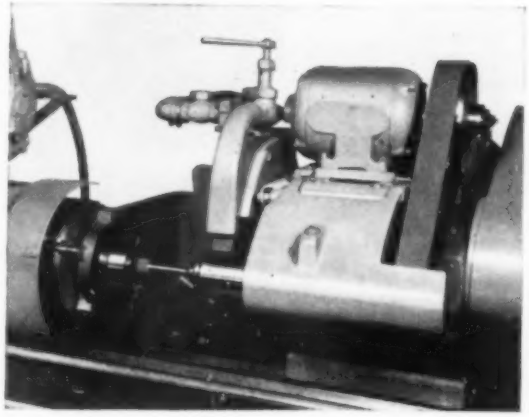
Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."

CINCINNATI

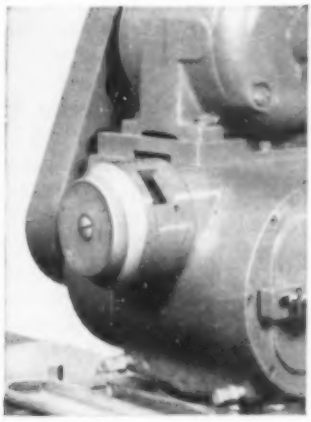
CINCINNATI

small lot precision grinding

3



4



Small manufacturing quantities may be good for inventory accounting, but they're tough on costs. In precision toolroom grinding, CINCINNATI® FILMATIC Universals offer several ways to eliminate or greatly reduce the setup element of cost.

1 **FILMATIC grinding wheel spindle bearings** require no adjustment for any job assigned to the machine.

2 **Two-speed cross feed mechanism** facilitates multiple diameter grinding; incorporates pick-feed all the way to final size.

3 **Internal grinding unit** is hinged at the front of the wheelhead casting, always ready for internal work.

4 **Instant work speed selection** for the diameter being ground. Just turn the dial with one hand, that's all there is to it.

5 **Power rapid positioning** of wheelhead. Saves time and energy, especially when setting up for widely varying diameters (extra equipment).

5

FILMATIC

Other ways in which new CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI® FILMATIC 12" X 36" UNIVERSAL GRINDING MACHINE

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Use postpaid card. Circle No. 201

Letters to the Editor

Editor's note: We recently queried the National Machine Tool Builders' Association about the significance of the special machine tool and whether its share of the total machine tool market was on the increase. Here is Mr. Tell Berna's interesting reply:

In the first place, before you can determine whether or not there is a trend away from standard general purpose machines and toward special machines, you have to make up your mind how you are going to determine "standard general purpose" and "special." Before you can measure the number of apples produced in the United States you have to agree on what constitutes an apple and how many apples there are in a barrel.

Broadly speaking, all of us know that there has been a trend toward purchasing the machine with a specific job in mind. When I was a kid, a metalworking plant might have a planer (if they were lucky), a shaper, a radial drill and a lathe. If a job came in that did not lend itself to these machines, they rigged up some kind of a special arrangement, usually called a "dutchman" and got by as best they could. They would plane curved surfaces on a planer—they would swing a bigger job than the lathe was designed for by putting wooden blocks under the headstock, etc. That is expensive and we have been trying to get away from it. More and more machine tool builders sit down with their customers, study their jobs, and then recommend what is best for that customer's need. You can call that engineering, and of course there has been a tremendous increase in the engineering service that machine tool builders render to their customers, but that doesn't necessarily mean that there is a growing percentage of machine tools that we may call "special."

This is a question which has been discussed a million times with our friends down in Washington who like to write regulations applying to "standard general purpose" or "special" machines, but nobody has ever been able to draw a sharp and satisfactory line between those two broad groups.

Let us agree, for the sake of argument, that a 3′ radial drill is a standard machine. What is a turret lathe? You send your standard turret lathe to your customer, but with it you send a complement of tooling, some of which may be brand new and especially designed for the purpose. Does that make the turret lathe a special machine?

Consider a multiple spindle bar machine. It is basically a standard machine built in lots. But it is tooled up before it is shipped and perhaps one-third of the value of the machine may be in that special tooling. On occasion, such a machine has been equipped for heat treating, on another to cut a gear. Is an automatic bar machine "standard" or "special"?

How large a percentage of the total value of the equipment must be due to special equipment before the machine becomes special? Of course there are many machines that fall into the standard classification without question, and some that are special beyond a doubt. But the boundary between the two is very wide and endlessly complex.

There has been so much hullabaloo about automation—whatever that is—and so much attention paid to the novel features of some machines, such as the lathes which reproduce from a template, the die sinking machines which duplicate in three dimensions, the transfer machine with its conveyor, and the machines that automatically gauge and reject scrap or correct their own errors without the attention of the operator, that we are likely to forget that the backbone of the metalworking industries of the United States is machines that are, beyond question, standard general-purpose machines. Whatever special machines you may need, you still have to have a lot of standard general-purpose machines.

I might add that there has been improvement in the design and construction of standard general purpose machine tools as striking as the development in any sector of the industry, but that fact has been generally overlooked and is not sufficiently appreciated.

Tell Berna
Senior Consultant
National Machine Tool Builders' Association

Ball Grinding

We are very interested in obtaining additional copies of the excellent article "How Precision Steel Balls are Ground and Finished" on page 27 of the December Issue of your publication. We could make good use of 50 to 100 copies of this article, if that many copies are available. Please let us know the cost and we will send you our Purchase Order to cover.

K. Josephson
Advertising Manager
Marlin-Rockwell Corp.

E. F. HENNIS
New York

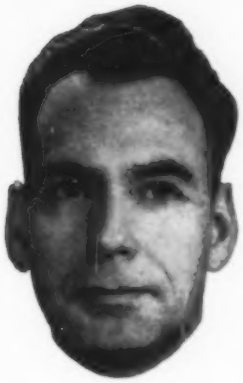
This Panel

RICHARD O. MORIN
Philadelphia

R. H. DYSON
Chicago

C. J. VANDIPTEN
Voorburg, Holland

J. K. AIKEN
Springfield, Vt.



L. GRAHAM COLLINS
New York

F. WARD HIGGINS
New York

of Experts Has Never Been Stumped

BERNARD C. DAY
Cleveland

T. D. DETHEROW
Chicago

WALTER AUGUSTEN
Indianapolis

Their "Category" is Internal Grinding

CALEB C. BROWN
Dayton

L. C. GILCHRIST
Detroit

E. F. HAWKINS
Detroit

Ask Them to Solve Your Problem

Phone one of these men at the office nearest you

BRYANT Chucking Grinder Co.

85 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

Use postpaid card. Circle No. 203

NOW for longer, faster action in heavy-duty grinding . . .

SIMONDS

New IL BOND

What goes in here .

IL Bond gives a distinctly different grinding action—cutting rate is increased *without* affecting wheel life. If your present *cutting rate* is satisfactory IL Bond in harder grade will give longer life. If your present *wheel life* is satisfactory IL Bond in same grade will increase cutting action. Write for descriptive bulletin.

. Makes a BIG difference here!

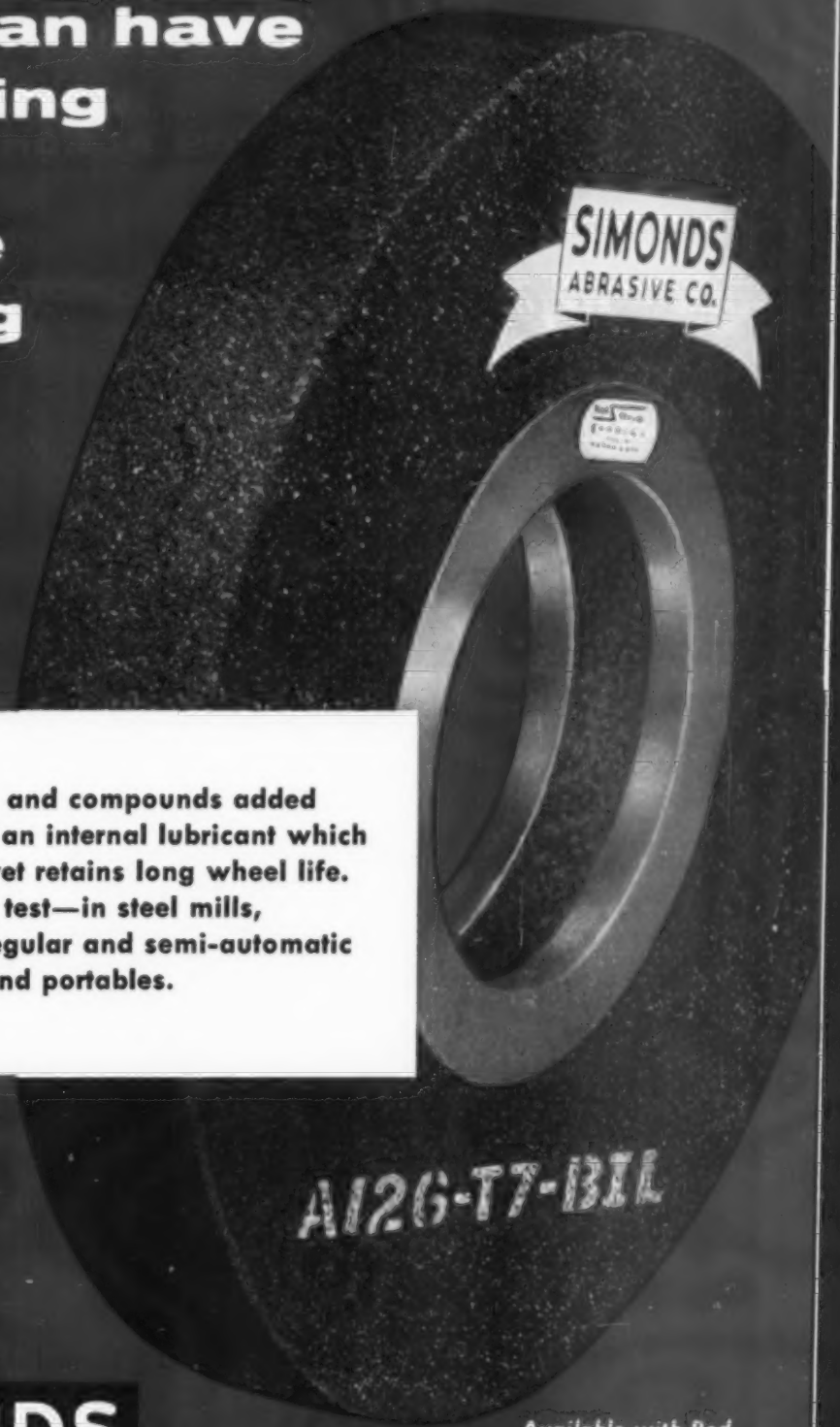
SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCH WAREHOUSES: BOSTON, DETROIT, CHICAGO, LOS ANGELES, SAN FRANCISCO, PORTLAND

NOW you can have the fast cutting action of a softer grade with the long life of a hard wheel



It's in the wheel mix! Special chemicals and compounds added to conventional resinoid bonds provide an internal lubricant which increases the abrasive cutting action—yet retains long wheel life. Demonstrated and proved—in test after test—in steel mills, foundries and industry generally—on regular and semi-automatic swing frame grinders, on floor stands and portables.

Try

SIMONDS
ABRASIVE CO.

Available with Red Streak Flanges — for metal to metal fit on mounting equipment — another Simonds Abrasive exclusive.

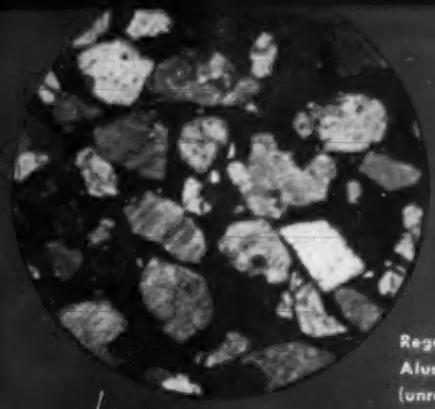
SNAGGING WHEELS with *New* IL BOND

NEW in toughness

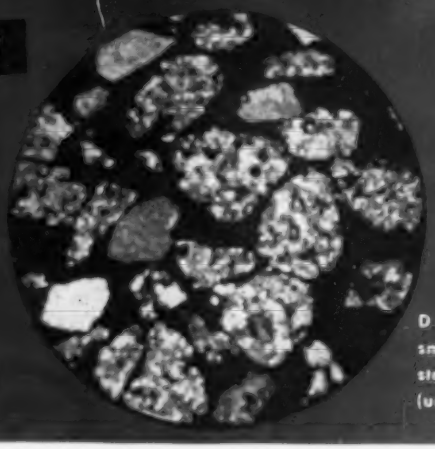
NEW in cutting action

NEW in grinding economy

NEW



Regular Aluminum Oxide (unretouched)



D A Borolon smaller crystal structure (unretouched)

SIMONDS

DA *Borolon*® TRADE MARK

for resinoid bonded snagging wheels

A big forward step to new efficiency in grinding steel mill billets and foundry castings. Note the smaller crystalline structure of DA Borolon within each abrasive cutting particle! This means inherent toughness to resist fracture during grinding stress . . . more and sharper cutting edges on the wheel face . . . longer, useful wheel life . . . and more production per wheel dollar. Test after test on swing frames, floor stands and portables prove that Simonds wheels with this new aluminum oxide abrasive belong on your grinders for more production at lower cost. Write for descriptive bulletin.

Use postpaid card. Circle No. 204

NEW LIFE

for more grinding . . .

SIMONDS ABRASIVE CO.

GRINDING WHEELS

with DA Borolon®

TRADE MARK

CALL YOUR SIMONDS DISTRIBUTOR

LOCAL STOCK
FAST SERVICE

SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA, CHICAGO, DETROIT, LOS ANGELES, SAN FRANCISCO, PORTLAND, ORE.

VAN NORMAN

No. 4BG1 Bowgage Production Grinder

10 Tons of Massive Rigidity

for Extra Precision, Performance and Economy in Mass Production Grinding

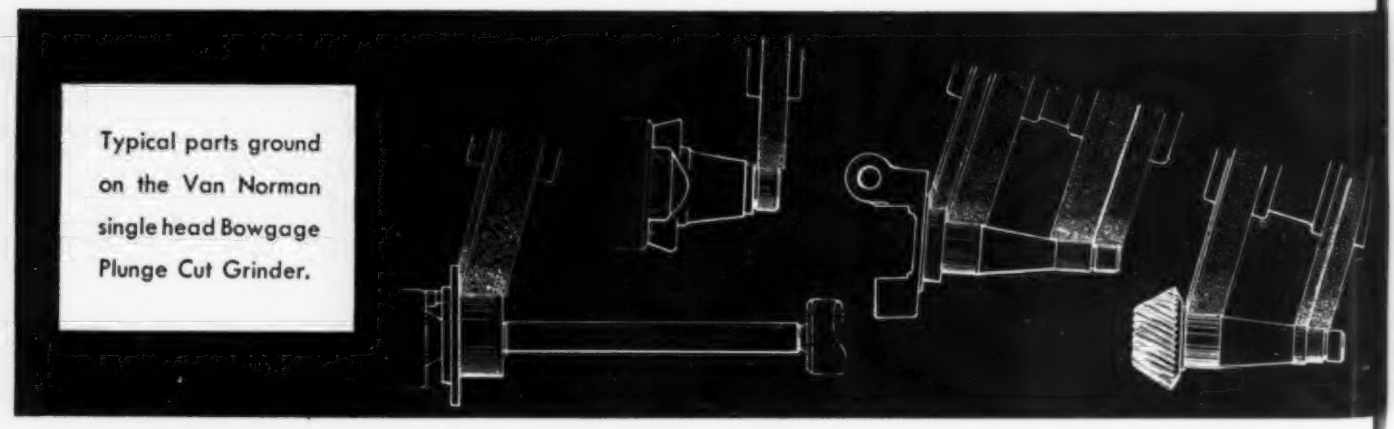
The No. 4BG1 Bowgage plunge cut grinder was developed for a leading automotive manufacturer for grinding pinion shafts. This 10 ton brute assures extreme accuracy and increased production by 50%.

Van Norman production grinders feature the exclusive Van Norman Bowgage wheelheads.

These rugged heads are completely self-contained grinding units with feed-back gauging, size compensation, and exclusive diminishing feed, and automatic cycling. By simply taking one or more Bowgage wheelheads and mounting them on a suitable base, there is practically no limit to the number of diameters, tapers, shoulders, etc. that can be ground to close tolerances automatically. Automatic size control to .0002" plus multiple step contour grinding can assist you to increase production, cut grinding costs. Formed dressed wheels can be profiled to accomplish step grinding for as many as 6 diameters at one time.

Specialized application in precision grinding for mass production can be designed into single or double head grinders to fit your particular requirements.

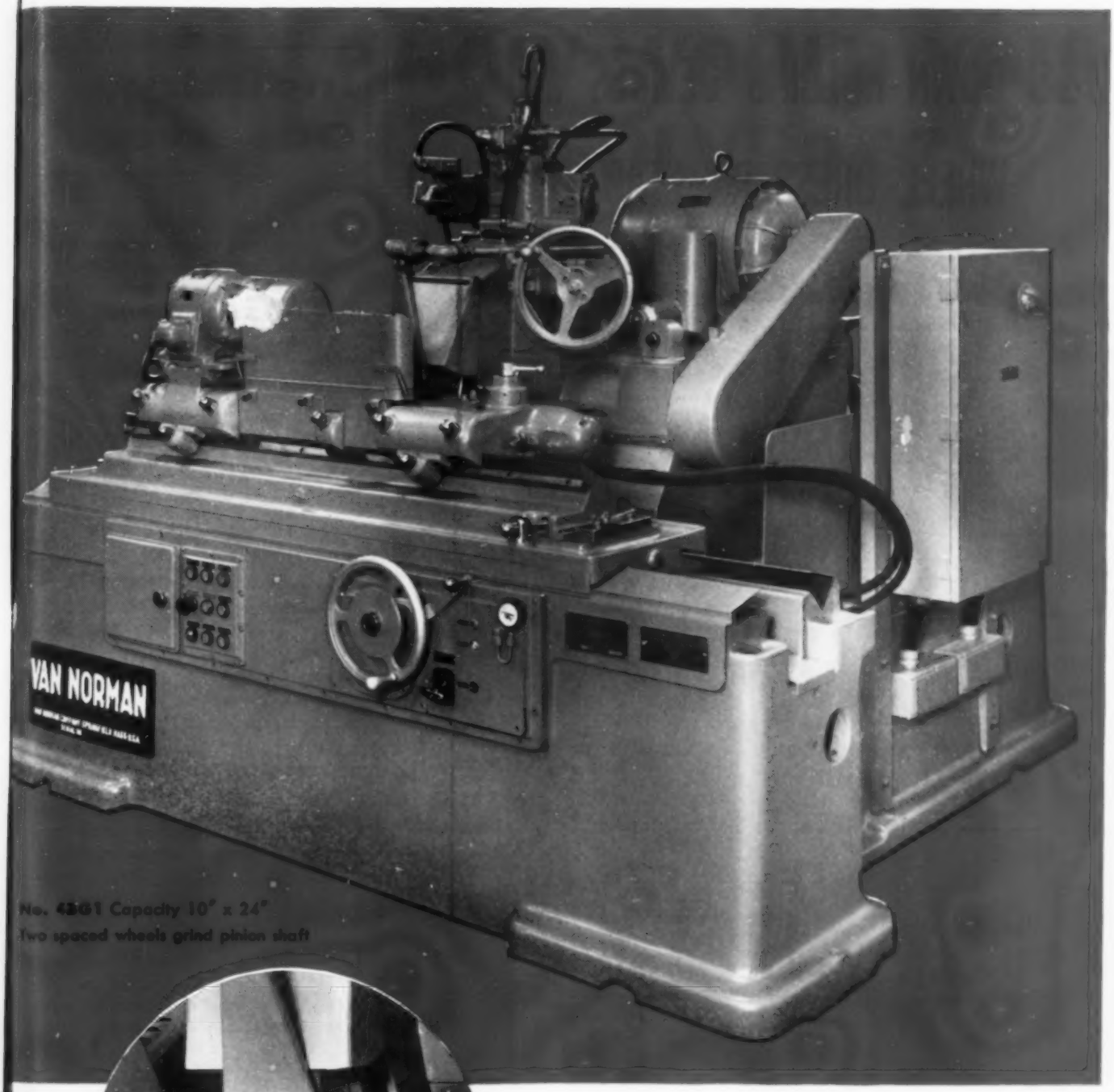
Write for catalog or engineering assistance.



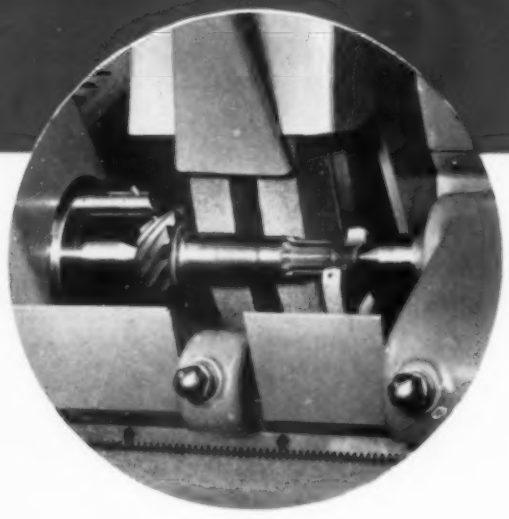
Typical parts ground on the Van Norman single head Bowgage Plunge Cut Grinder.

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



No. 42G1 Capacity 10" x 24"
Two spaced wheels grind pinion shaft



Don't wait . . . for extra profits install a Van Norman Machine now! They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . up to 10 years . . . See your dealer or write Van Norman Machine Company.

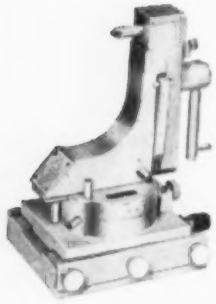
Conditional Sales Contracts not available to Export.

COMPANY

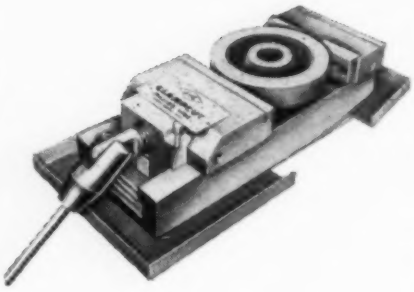
SPRINGFIELD 7, MASSACHUSETTS

Use postpaid card. Circle No. 207

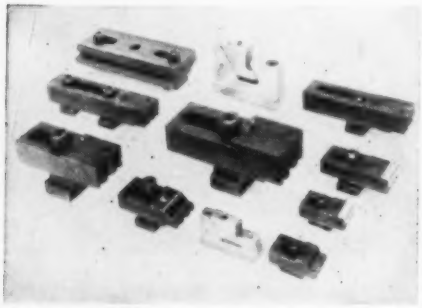
J&S DOWN-HOLDING DEVICES and WHEEL DRESSERS LEAD THE FIELD



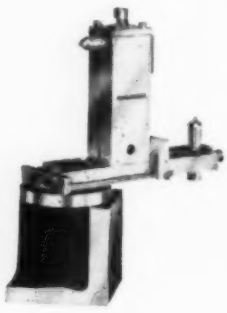
Fluidmotion Wheel Dressers—Dress two angles tangent to a radius, using ONE handle in one continuous motion. Operation is so fast and simple that beginners can use them. For all types cylindrical and surface grinders.



J & S Swivel Vise—The only hardened and ground swivel vise that mounts low, swivels, needs no pedestal. Patented down-holding clamping jaws give many times the holding power of an ordinary vise, yet only half the weight.



J & S All-Purpose Jaw Clamps — For any machine table or face plate. Five models—one adjusting screw has a holding force of 2½ tons on Small model, 12 tons on Jumbo model. Eliminate u-clamps, straps and fingers. No obstruction problems, no interference with measuring tool readings.



J & S Form-Master—Sturdy wheel dresser for shops with less frequent wheel dresser requirements. High quality, 100% dust-proof, it is capable of dressing any radii up to 12″ convex, up to 15″ concave.

Write for free literature and further information.

J&S TOOL CO. INC. — JAW CLAMPS • PRECISION VISES • DOWN-HOLDING DEVICES — **CLAMPCUT**

J & S TOOL CO., INC. | **880 DORSA STREET LIVINGSTON, NEW JERSEY**

Use postpaid card. Circle No. 208

Industry Observer

Diamond tool price increases around the first of the year were due to increases in the mine prices. Advances in industrial diamond prices ranged up to 8.5 per cent in some cases. Tools using diamond bits haven't risen as much as diamond wheels, because a large portion of the cost of single diamond tools is the labor cost. The diamonds themselves are the expensive items in diamond wheels.

At a press conference on January 21, Micromatic Hone Corporation revealed further development of some honing applications announced at the 1955 Machine Tool Show. Micromatic demonstrated honing of ball bearing raceways and honing of automotive ball studs. Full coverage of these developments in our March issue.

Third quarter sales and earnings figures for manufacturing industries just released by the FTC and the SEC show a decline during the third quarter. This is attributed to the steel strike and lower auto production for the period. According to the report, net profits after taxes in the third quarter amounted to $3.6 billion, compared to $4.2 billion in the previous quarter. Sales in the steel and auto groups were lower by 29 per cent and 19 per cent, respectively, compared with the previous three months. Sales by other groups showed mixed trends.

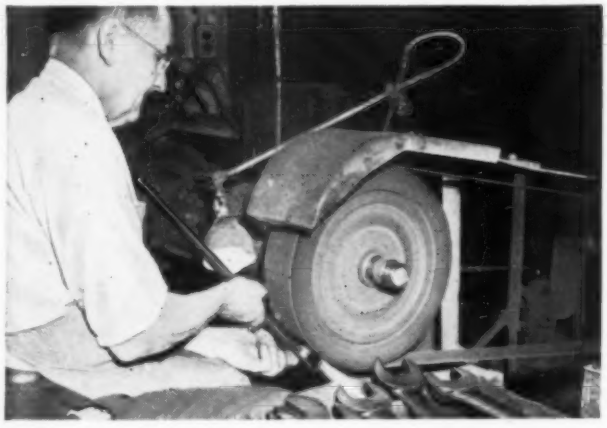
Solar Aircraft has been awarded an Air Force contract for $1,300,000 of production facilities for J75 jet engine components. The J75, an advance design 15,000-pound thrust engine, was designed by Pratt & Whitney, and is being built by Ford Motor Company's Aircraft Engine Division in Chicago under license from Pratt & Whitney.

The expanding industrial economy of Latin America isn't going unnoticed by abrasive companies. Norton Company has acquired a controlling interest in a prominent Brazilian firm manufacturing coated abrasives, grinding wheels and abrasive grain. This marks acquisition of the second Norton plant in South America. Word has also reached us that a modern abrasives plant is being contemplated by a firm in Columbia, who are interested in producing a full abrasives line.

HOW WOULD YOU SOLVE IT?

1 PRODUCTION PROBLEM: To speed production and cut unit costs of removing forged flash from steel open-end wrenches. Billings and Spencer found that hard wheels were too slow, left unsatisfactory finishes, tired operators.

2 SOLUTION: A 3M Representative studied this production problem. After analysis, he recommended that this Hartford, Connecticut manufacturer switch to the 3M Method using Three-M-ite type belts on a backstand grinder.



3 RESULTS: Better finishes. An immediate production increase of 140%—from 75 to 180 pieces per hour. Each belt finishes up to 150 pieces (and then is used for *other* operations) with far less operator fatigue. A 3M Representative can solve *your* problems, too.

Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P.O. Box 757, London, Ontario. Export: 99 Park Ave., New York 16, New York.

3M ABRASIVES

PRODUCT OF 3M COMPANY RESEARCH

WANT MORE INFORMATION?

MINNESOTA MINING AND MFG. CO.

Dept. IU-27, St. Paul 6, Minn.

☐ Send me free booklet: "Grinding and Polishing Hand Tools"

☐ Please have 3M Representative call

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE__ STATE_____

Use postpaid card. Circle No. 209

Stuart SOLVOL

LIQUID CUTTING COMPOUND

Lubricates as it Cools

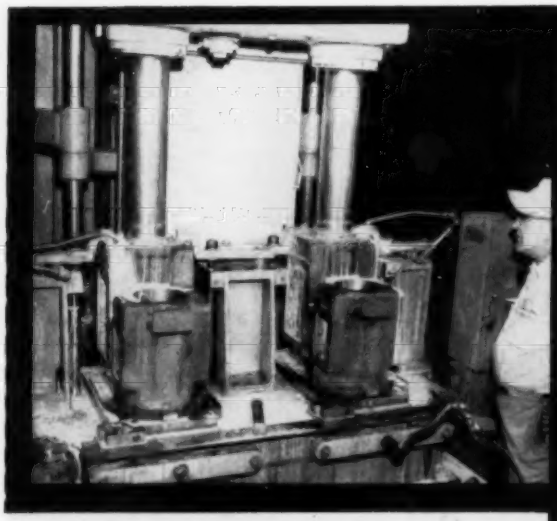
Keeps Gardner-Denver Company's difficult production jobs "right at peak"

"Solvol prolongs cutting-tool life . . . increases production . . . reduces costs . . . and keeps production right at peak," —that's the report from Gardner-Denver Company, Quincy, Illinois, where Stuart's Solvol is used as a multi-purpose cutting oil to produce profit-boosting benefits ordinary "coolants" can't give.

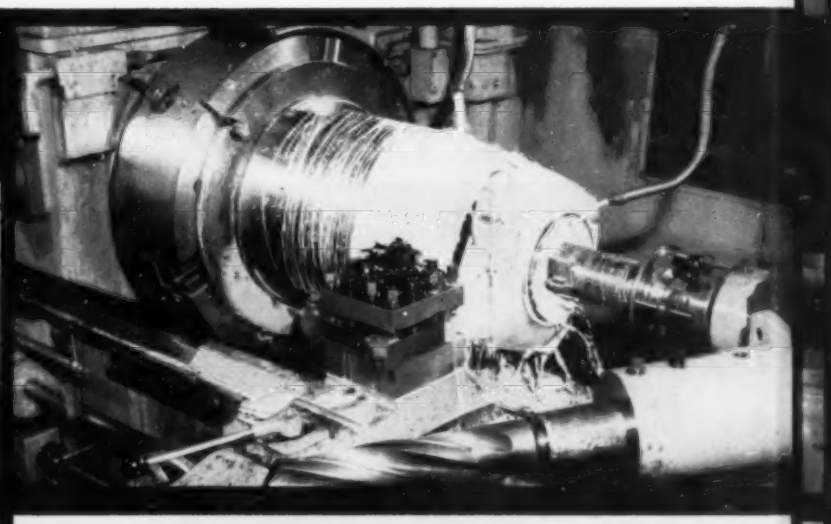
Solvol's excellent combination of lubricating and cooling qualities has stepped up performance on 30 different machines used for milling, drilling, turning, and boring in this manufacturer's main plant at Quincy, Illinois. The four jobs illustrated are typical of the way Gardner-Denver engineers maintain machine and cutting-tool efficiency, producing parts for compressors, pumps, rock drills, and other heavy equipment.

They are typical, also, of the way Stuart's Solvol is used in profitable plants everywhere for high-speed turning, vertical surface broaching, round hole broaching, and similar heavy-duty jobs on which water-mix cutting oils are indicated.

For Solvol *lubricates as it cools*, keeps tool wear down by providing a tough protective film of oil at the cutting edge . . . allowing chips to slide freely up the face of the tool . . . minimizing heat caused by friction on heavy cuts taken at high speeds.



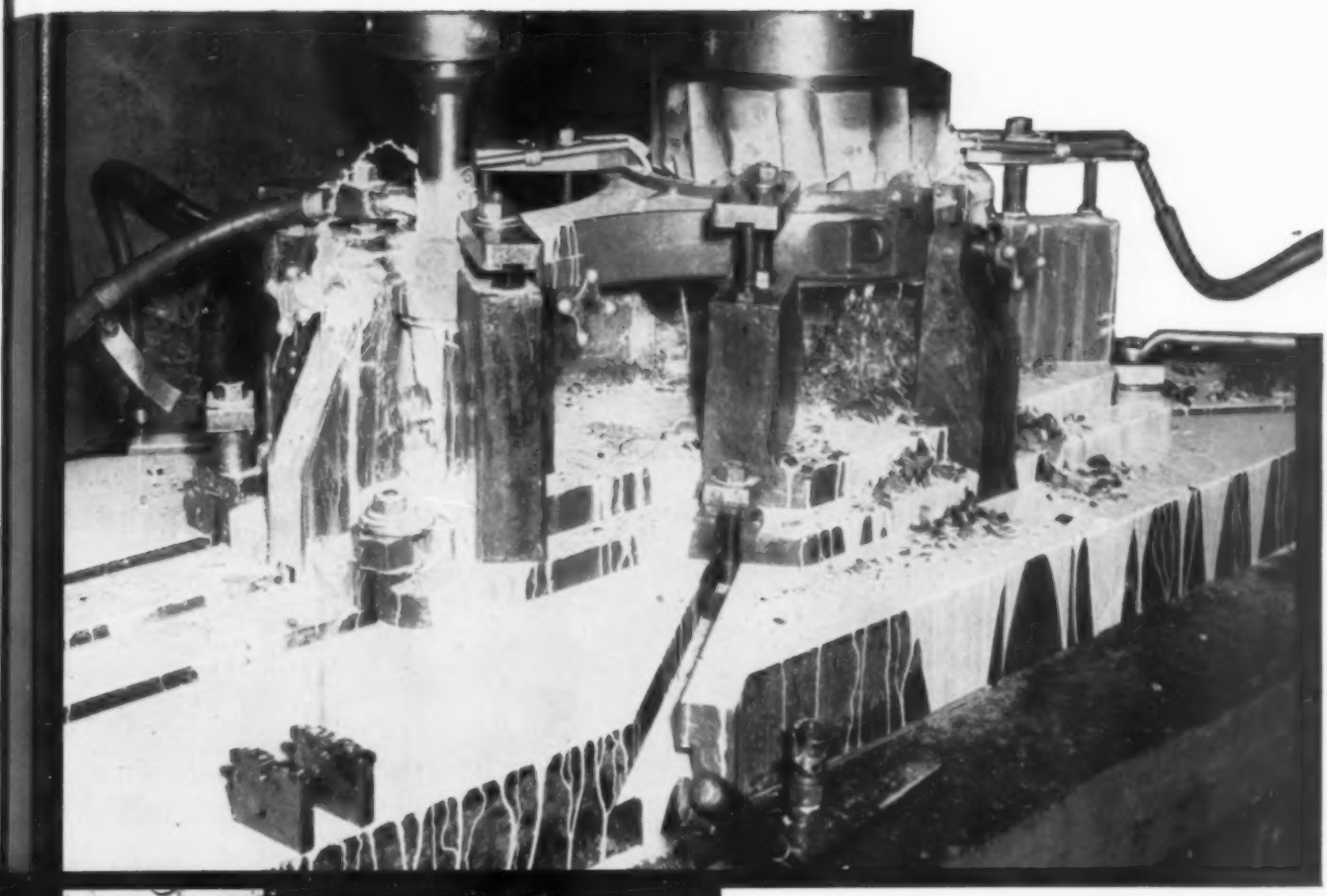
Boring operation on cast-iron compressor cylinders removes .019 in. stock. Feed is 3.5 in. per minute . . . production time, 7.69 minutes per piece. Solvol eliminates "edge build-up."

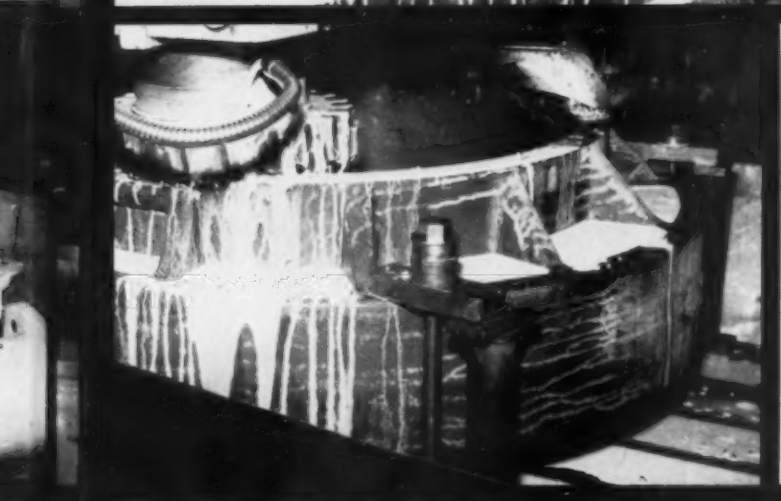


Prolongs tool life on this high-speed turning operation. Up to ¼ in. of stock is removed from these cast steel cylinder cross-heads at speeds of 300 sfpm. Standard 30-to-1 Solvol and water *absorbs heat rapidly and reduces friction for good utilization of power without excessive tool wear.*

SOLVOL helps you cross the heat barrier in metal-cutting

Stuart's Solvol liquid cutting compound controls the heat problem more effectively on practically all high-speed metal-cutting operations. Each ingredient of Solvol was chosen for specific qualities which prolong cutting-tool life . . . protect machines . . . maintain high standards of accuracy and finish . . . and assure greatest on-the-job economy. Solvol has high detergency plus superior emulsifying and rust-inhibiting qualities. Heavy-duty pure fatty oil increases surface wetting characteristics and boosts the lubricating factor of the petroleum base. Experience-proved emulsifiers increase stability and prolong Solvol's effectiveness. Standard starting mixture is one part Solvol to 30 parts water . . . other mixtures are used to meet unusual requirements. Your Stuart sales engineer will be glad to give you specific recommendations that reduce your operating costs and step up performance.





Tough milling job upgraded by Solvol's lubricating, cooling, and anti-rust qualities, machining two bores in heavy cast steel connecting rods (above). No chip "weld" on cutting edges . . . *lubricating and rust-inhibiting* qualities protect machine and fixtures. Pregrind operation removes up to .010 in. stock from each bore. One rod finished to within ± .002 in. every 33 minutes.

Carbide-tipped face mill takes heavy cut on this large slush pump connecting rod. Solvol withstands high unit pressures . . . provides *a tough film of lubrication* to reduce friction and prevent excessive heat build-up.

Phone your
Stuart Service Center

Arrange now to test Stuart's Solvol on your difficult metal-cutting jobs.

DETROIT, MICH.	Tyler 7-8500
CHICAGO, ILL.	Bishop 7-7100
HARTFORD, CONN.	Jackson 7-1144
CLEVELAND, OHIO	Prospect 1-7411
PHILADELPHIA, PA.	Devonshire 8-6100
TORONTO, CANADA	Oxford 9-9397

Representatives in all principal cities

SINCE 1865

D. A. STUART OIL CO.
2727 South Troy Street, Chicago 23, Illinois

CANADIAN D. A. STUART OIL CO., LIMITED
3575 Danforth Avenue, Toronto 13, Ontario

Stuart

METALWORKING LUBRICANTS

Use postpaid card. Circle No. 210

clear
transparent

K-7

NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K-7 users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol.. LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 218, PORTLAND, CONNECTICUT

Use postpaid card. Circle No. 211

Reprints

Available on request are the following free GRINDING and FINISHING reprints:

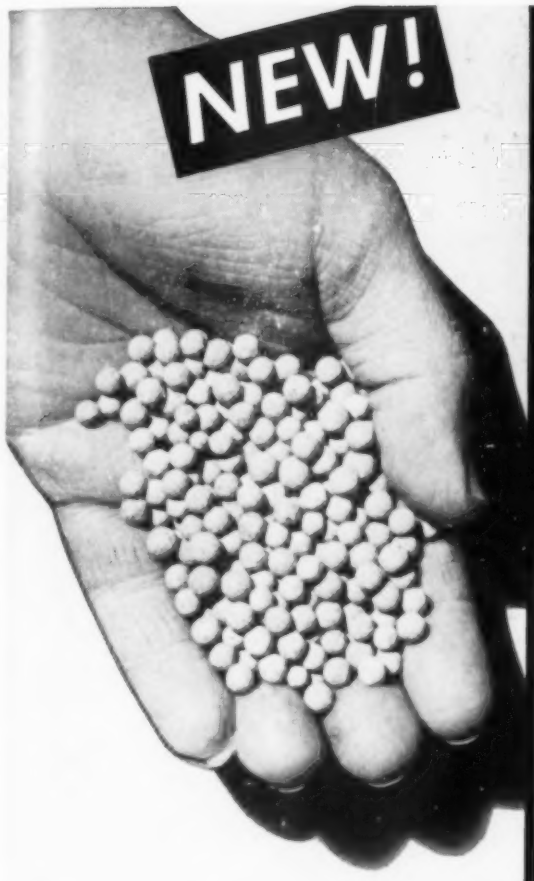
1. **Precision Grinding and Lapping at Sundstrand Aviation** by Jack Kenyon. Summary of interesting operations on aircraft accessory parts in one of the nation's leading high-precision shops.
2. **Determining Diamond Concentration in a Diamond Wheel** by F. W. Lindblad. Concentration of diamond particles, their size and arrangement all vitally affect diamond wheel performance.
3. **Belt Grinding Gas Turbine Parts** by Leo F. Byrnes. Belt grinding operations are vital to production of General Electric stationary gas turbines.
4. **Classifying Tool Steels by Grinding Characteristics** by J. A. Weir. Selection of proper grinding wheels for tool steel grinding.
5. **Finish Measuring Techniques** by E. W. Bolles. Keep up with the latest ASA standards on surface roughness.
6. **Workholders and Drivers for Precision Grinding** by Harry Conn. A summary of recent developments in workholding devices.
7. **Gear Honing.** New process uses honing principles to generate gear teeth. Improves gear sound characteristics.

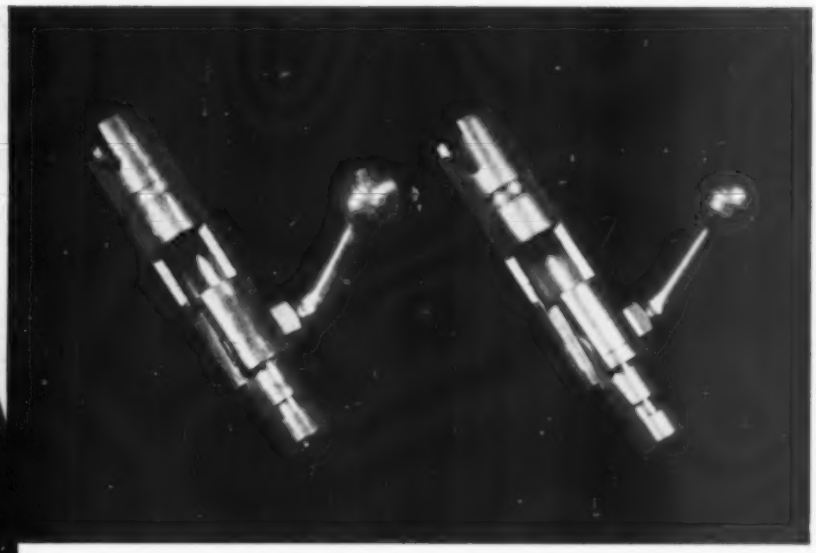
Also available, at 35c per copy:

8. **Centerless Grinding** by G & F Editorial Staff. Reprint of a comprehensive five-part treatise on centerless work, including advantages, applications, economics, fundamentals, methods, machines, attachments, blades, setups, wheels and common troubles encountered.
9. **Organizing and Operating a Precision Barrel Finishing Department** by Morris S. Shipley and William A. Biebel. How yesterday's rough-and-tumble methods have given way to precision barrel finishing. 30-page report covers applications and limitations, selection of equipment, media and compounds, methods and hints to operators, and organizing and operating a department.

• • •

Address reprint requests to: **GRINDING & FINISHING,** 222 East Willow Ave., Wheaton, Ill.





The new ALUNDUM Tumblex "S" abrasive rolls around and through intricate parts; brings high uniformity of radii and surfaces, with smooth finish, to the barrel-finishing of parts as intricate as this gun component. The "before and after" view shows you how the spheres improve external and *internal* areas.

Besides this 3/16" diameter size of Tumblex "S" you can order it in four other sizes, up to 7/8". This means top barrel-finishing performance for you, in many different applications. And these new spheres are exceptionally dense and long-lasting.

Another big advance in barrel-finishing

Norton Tumblex "S" abrasive spheres

From the pioneer of ALUNDUM bonded triangles — now, new bonded spheres to help you do a better job*

If you finish parts that have hard-to-contact recesses or intricate shapes, Tumblex "S" tumbling abrasive is the latest development.

Here are the reasons why tubing, coil springs, scissor handles, bearing retainers, pump bodies and many other parts benefit by the new shapes and sizes of Tumblex "S" — and its top-quality as a tumbling abrasive.

- *Tumblex "S" is made in spheres that easily get into areas where other abrasive shapes can't reach.*
- *Made of famous Norton ALUNDUM abrasive, it cuts fast — resulting in shorter time cycles and lower costs per piece finished.*

5 Different Diameter Sizes

#2—7/8"	#4—3/8"
#3—5/8"	#5—9/32"
#6—3/16"	

Send Your Work Samples

Let us demonstrate in our newly enlarged Sample Processing Department how Tumblex "S" Abrasive can give the value-adding "Touch of Gold" to your product quality and cut your barrel-finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

G-321

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

Circle No. A1 on postpaid card

Users tell you . . .

How Norton wheels cut O.D. grinding costs and improve quality

Here's the "Touch of Gold" to give your cylindrical and centerless grinding great advantages

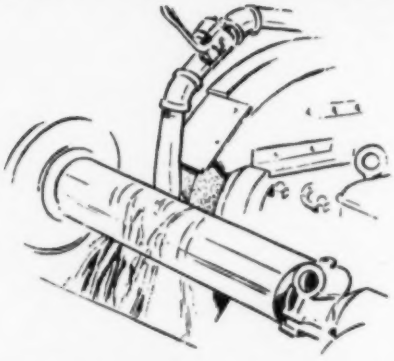
Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per wheel and dressing . . . easier dressing, with less wear on diamond or crushing roll.

Those are typical benefits reported by Norton G Bond and BE Bond wheel users all over the country — concerning every type of O.D. grinding.

It's all because both G Bond and BE Bond are so particularly well adapted to the needs of cylindrical and centerless grinding. Wheels made with them hold each abrasive grain just long enough for maximum cutting action — and outperform all other wheels in many grinding operations, precision or semi-precision. The new Norton "44" ALUNDUM abrasive is proving to be the most outstanding non-premium-priced abrasive for many O.D. grinding jobs.

Here we can show just a few of the on-the-job photos and facts passed on to us. Look them over — and note how these wheels can add the "Touch of Gold" that will boost your own product quality and profits.

Typical Performance Reports on "44" ALUNDUM* Abrasive

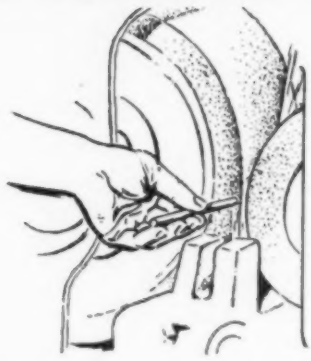


CYLINDRICAL GRINDING

A WISCONSIN PLANT, grinding 2″ to 4″ diameter steel shafts, 12″ length, reports 44 ALUNDUM wheels (44A54-KVBE) cut faster and cooler with no sacrifice of wheel life, compared with best previously used wheels.

A MICHIGAN PLANT, grinding miscellaneous high speed steel bolt heading dies finds 44 ALUNDUM wheels best. Reasons are more pieces per dressing, cooler cutting action and 30% longer wheel life than formerly used wheels.

A NEW JERSEY PLANT found a 44 ALUNDUM wheel (44A36-MVBE), plunge grinding different steel parts, gave many more pieces per dressing and averaged 15% longer life than wheels they used before.



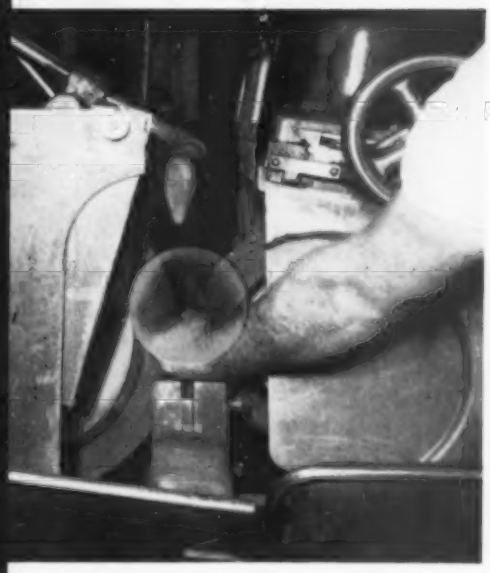
CENTERLESS GRINDING

A MICHIGAN PLANT, of the smaller jobbing types, grinding all kinds of materials. They prefer 44 ALUNDUM wheels (44A801-NVBE) for versatility, less dressing and faster cutting — including 10-hour completion of a job which used to take 14 hours.

AN OHIO PLANT removes .008″ on the rough grind and .003″ on the semi-finish grinding of No. 1010 steel crankshaft pins, ¾″ diameter x 4″ length. While standard wheels gave them an average of 600 pieces per dressing, they report a 44 ALUNDUM wheel produced 1,000 pieces, by retaining its sharp cutting face longer. All stock was removed in one pass, compared with two passes formerly required.

ANOTHER MICHIGAN PLANT, of large size, tested a 44 ALUNDUM wheel in grinding hardened steel tappets. They report more pieces per dressing, faster cut and less burn than ever obtained before.

"G BOND WHEELS LAST US UP TO 40% LONGER," reports this centerless grinding customer. He found that wheel life increased profitably because this greatly improved vitrified bond breaks down so evenly. Workpieces are tapered shank vanadium steel spindles, 10" long with ¼" diameter — plunge ground to remove an average of .045".



"WE NOW GET 800 PIECES PER DRESSING with G Bond wheels, as against 500 pieces with previous wheels. Also, we get 50% longer wheel life, a finer finish, and the shoulder holds up much better." That's the report on this plunge-cut centerless grinding job. Work is a ¼" diameter, 1" long stud from which .012" is removed, to .0005" tolerance and 20 microinch finish.

"WE INCREASED PRODUCTION RATE 35% with G Bond wheels, besides greatly improving finish." These valuable "Touch of Gold" advantages are reported on a cylindrical grinding job calling for .025" stock removal from stainless steel tubing. The operation is also on a Norton machine — a reminder that only Norton offers you such long experience in both grinding machines and grinding wheels, to help you produce more at lower cost.

ASK YOUR NORTON DISTRIBUTOR for further proof of how Norton O.D. wheels can bring you best possible results. He'll gladly arrange a test in your plant. Distributors in all industrial areas listed under "Grinding Wheels" in the yellow pages of your telephone book. Behr-Manning Division, Troy, New York. *Export:* Norton Behr-Manning Overseas, Inc. **For information write Norton Company, Worcester 6, Mass.**

W-1772

NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS:
Coated Abrasives • Sharpening Stones
Behr-cat Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

Circle No. A2 on postpaid card

PARKER • MAJESTIC **pm** PRECISION MACHINES

PARKER SPINDLES

FOR ANY MACHINE—FOR ALL APPLICATIONS

Following its development in 1915 and as a result of constant improvements through the years, the Parker Spindle has become one of the most widely used spindles in this country today on many makes of machines. The demand for speed and endurance in grinding and precision boring which the Parker Spindle makes possible has made Parker-Majestic Incorporated the leading manufacturer of precision spindles.

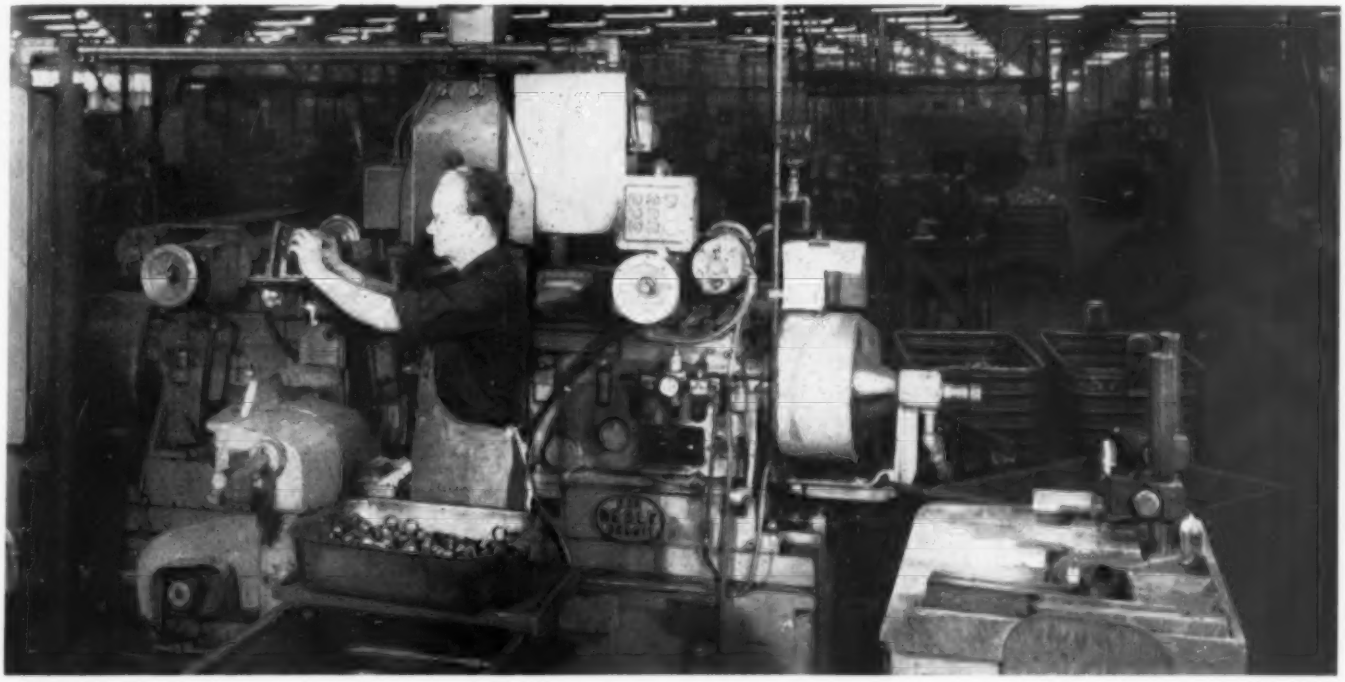
PARKER-MAJESTIC, INC.

147 Joseph Campau, Detroit 7, Michigan

Circle No. A3 on postpaid card

BESLY **Grinderscope**

NEWS AND VIEWS ABOUT WAYS TO CUT COSTS WITH MACHINES AND METHODS
FROM BESLY-WELLES CORPORATION, SO. BELOIT, ILLINOIS



Operator feeds bearing races into the specially designed "push-rod feed" mechanism on a Besly No. 226 Double Horizontal Spindle Disc Grinder. Setup for one man operation, this machine finish grinds both sides at once. Feeder can be easily automated if the runs are large enough to justify.

International Harvester's West Pullman Works

Parallel Grinds Difficult Bearing Races—In One Pass

on a Besly No. 226 Grinder

At the West Pullman Works, Chicago, International Harvester Company manufactures ball, implement and roller bearings, magnetos, carburetors, battery ignition units, chain, bolts and nuts, rivets and screw machine parts, such as bearing races, special screws and rotor shafts. These are made to supply parts for the many diversified products produced by West Pullman Works.

Since bearing races require precision fits wherever they are used, grinding is a necessary operation in their production schedule. Sizes ranging from 1" to 4½" in diameter must be finish ground on both sides to .0004" for parallelism.

NEW GRINDER INSTALLED

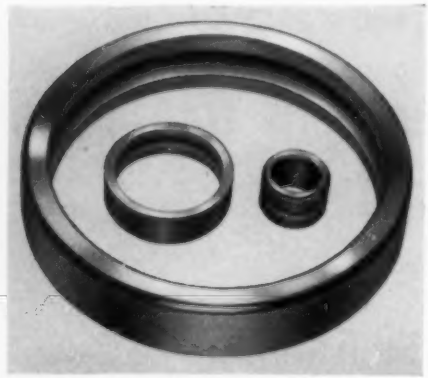
About two years ago, a Besly No. 226 Double Horizontal Spindle Disc Grinder was installed in the Grinding Department.

This machine is designed to wet grind bearing races on both sides simultaneously with 30" diameter abrasive discs. Besly's exclusive "Sealed Spindle Quill Construction" is designed to provide higher accuracy, faster production and greater flexibility with less maintenance than any other type of disc grinder. The excellent design of the box type cast iron coolant hood allows an abundance of coolant to be delivered to the grinding zone thru

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, So. Beloit, Illinois.

Rear view of the Besly 226 showing special chute for finished work. Parts flow down the chute automatically loading into bins.



All sizes of bearing races, from small almost square ¾" to 4½" in diameter are now ground on the same machine, easily meeting .0004" for parallelism in one pass.

the hollow spindles under complete control at all times.

How this grinding machine performed for West Pullman Works can be realized from these results.

PRODUCTION INCREASED

Besides increasing the production rate on all sizes of bearing races, both sides are ground in one pass, removing .013" to .017" of material. Tolerances of .0005" for squareness and .0004" for parallelism are easily maintained. In addition, lower machine maintenance and less scrap are obtained. Now, races are produced at the rate of 53 per minute for the smaller and 42 per minute for the larger . . . 50 to 60% more than the previous method.

ONE-MAN OPERATION

The addition of a special finished-work chute at the rear of the machine makes the unit perfect for one man operation. The parts are supplied in bins to the machine from the heat-treating process. Loading into a special feeder by the operator is simple. Push buttons control the machine and finished parts load automatically into empty bins ready for the next operation of O.D. centerless grinding. Tolerances are checked periodically on a convenient table without interrupting the flow of work.

PUSH-ROD FEED

A new feed unit, called a "push-rod feed," was developed which enabled West Pullman Works to more easily and quickly grind all sizes of bearing races.

Side brackets are adjusted in and out to take even the smallest as well as the largest races. Change-over time from one size to an-

other was reduced substantially. A considerable savings in man hours and down-time results in giving higher overall production rates and lower manufacturing costs.

Incidentally, this feeder can be readily automated at any time should a run become long enough to justify this expense.

EXTRA BENEFITS

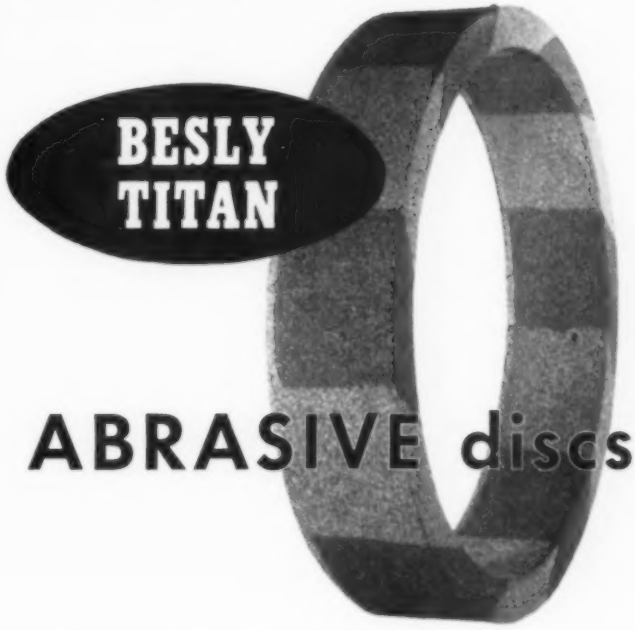
One of the major problems in grinding small races, where the diameter is less than three times the thickness, is that they must usually be clamped for production grinding. However, the Besly 226 grinds these parts perfectly within tolerances desired —in one pass . . . A considerable advantage to West Pullman Works. Proper feeding, employing the new "push-rod feed", and the high-precision grinding machine proved to be the answer.

Another benefit pointed out by West Pullman Works is that whenever other parts require parallelism, they are more quickly run through the Besly 226 first. Frequently parts require correction of warpage. These also are more readily run thru this machine. One pass does the trick. The cost and time savings are obvious.

Besly's many years of experience in the disc grinding field is always available for you to draw upon. If you have a grinding problem, or would like to know how you can cut costs and increase production, Besly Service Engineers will be glad to help you achieve worthwhile results. A bulletin describing the complete line of Besly Grinders is available on request.

SEND COUPON FOR BULLETIN NO. 200

New Improved **L H Bond***



*Patented

Reduces Gumming and Loading to New Lows, Increases Wheel Life and Cutting Efficiency

This new L-H Bond is the latest in Resinoid bonding agents now used in the manufacture of all Besly-Titan Abrasive Discs and Wheels. It is an improved crisping agent which permits the use of more filler and less bond. The original L-H Bond hit a new low in gumming or loading effect from heat caused in grinding. The new L-H Bond formula goes even further. Tests show that longer wheel and disc life with greater cutting efficiency can now be expected.

Besly-Titan Abrasive Discs and Wheels are custom-made to fit your requirements. They can be produced with any desired characteristics—even very hard grades—without overloading with non-cutting elements. Lower abrasive costs and higher grinding efficiency are assured.

Get a trial run . . . NOW . . . of a custom-made Besly-Titan Abrasive Disc or Wheel with the *new, improved* L-H Bond. The cost is no more than "stock" types. We are sure it can save you time and money, and produce better work. Ask us to run one for you.

NEW BULLETIN . . .

Get your free copy of Besly-Titan Abrasive Disc and Wheel facts. Send coupon below.

BESLY TITAN
ABRASIVES
SOLID DISCS • PERFORATED DISCS
CYLINDERS • WHEELS
Products of
BESLY-WELLES CORPORATION
Est. as Chas. H. Besly & Co., 1875
20 N. WACKER DRIVE
CHICAGO 6, ILLINOIS
Use postpaid card. Circle No. 212

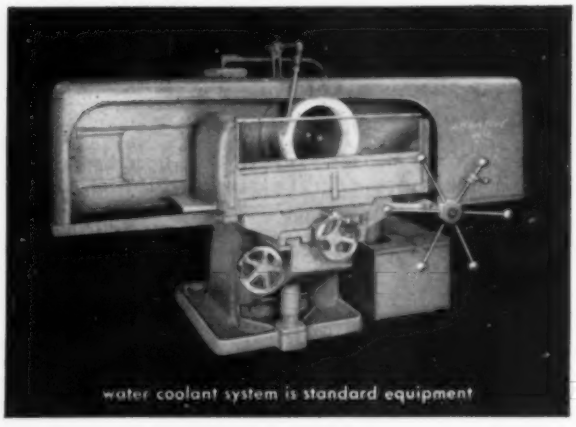
BESLY-WELLES CORPORATION
188 Dearborn Avenue
South Beloit, Illinois
Please send the following, free
☐ New Abrasives Booklet
☐ Bulletin No. 200 on Besly Double Horizontal Spindle Disc Grinders
Name .....
Company .....
Street .....
City ..... Zone ..... State .....

NEW IDEA!

why MACHINE it off—when you can GRIND it?

Stock really comes off with an Abrasive 18″ Face Grinder. Sixty-five thousandths of an inch at a pass! A rugged 15 H.P. motorized Abrasive spindle turns the wheel at 900 R.P.M. Surface speed is 4500 feet per minute. 24″ table travel, plus 18″ wheel gives big work capacity.

Time is money! Machining flat surfaces wastes both! Grind it off faster, with better surface finishes, with an Abrasive 18″ Face Grinder just as leading metalworking plants — those really making money — are grinding forgings, castings and dies.



water coolant system is standard equipment

TYPICAL APPLICATIONS ■ Castings . . . eliminates milling or planing . . . requires less stock to be left on for finishing . . . as much as 3/16″ of stock can be saved on each surface. ■ Automobile Body Dies. ■ Plastics Molding Dies. ■ Molded Insulating Fire Brick. ■ Ceramic Insulators. ■ All types of Forging Dies. ■ WHEREVER FLAT, SQUARE SURFACES ARE REQUIRED.

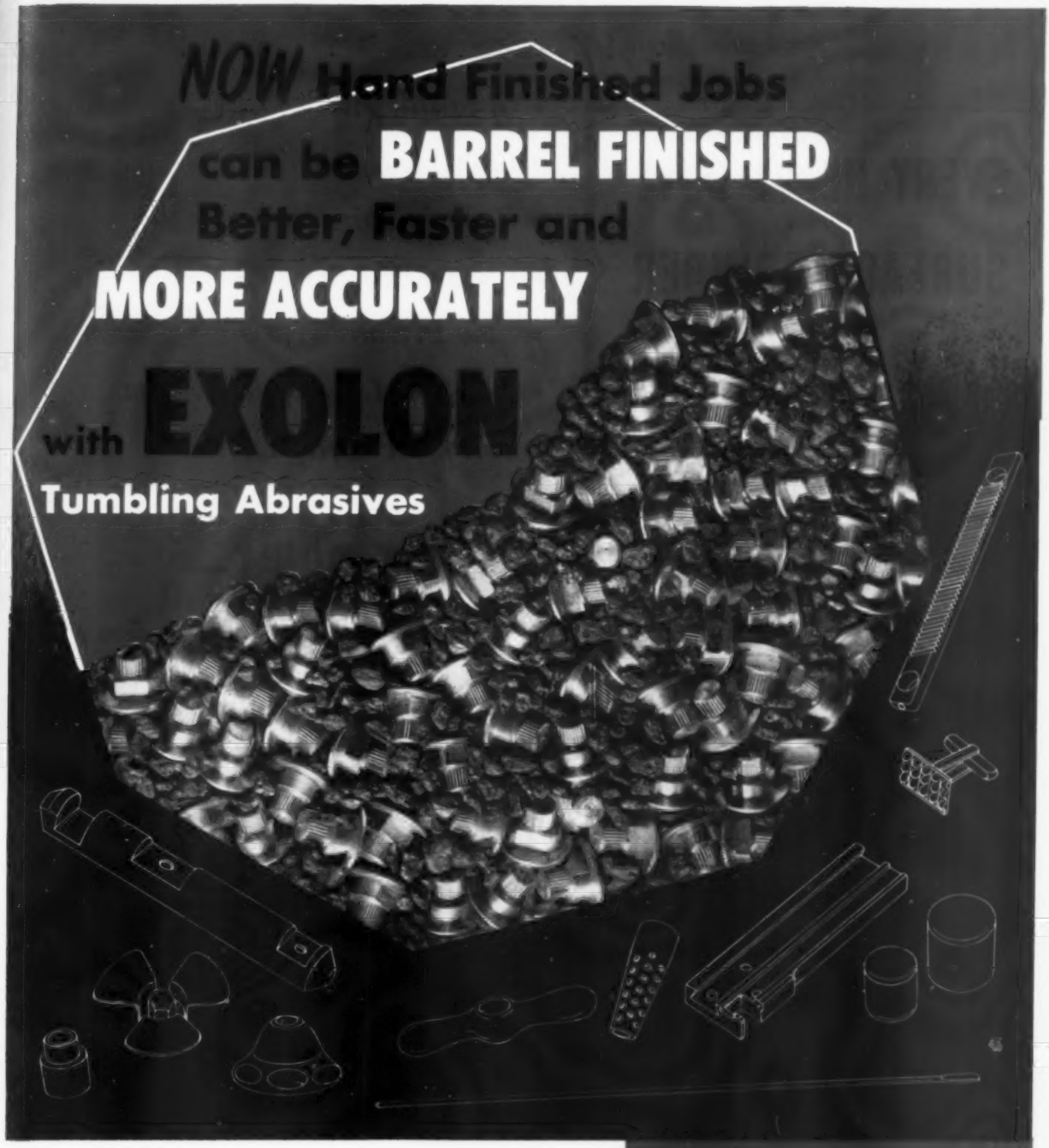
ABRASIVE
ACCURACY BOOSTS PRODUCTION

Complete, detailed, fully-illustrated Catalog is yours free. Write for it.

ABRASIVE
MACHINE TOOL COMPANY
EAST PROVIDENCE, RHODE ISLAND

Use postpaid card. Circle No. 213

NOW Hand Finished Jobs can be BARREL FINISHED Better, Faster and MORE ACCURATELY with EXOLON Tumbling Abrasives

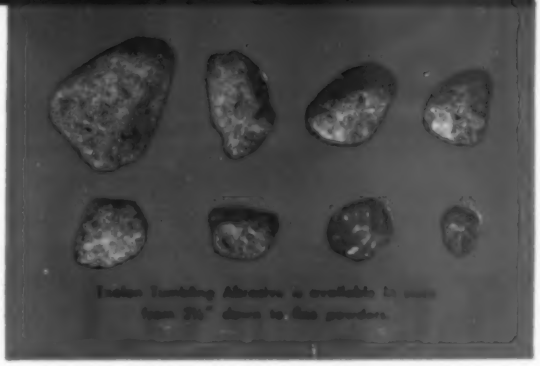


Barrel Finishing today is an accurate, scientific method of metal removal. Gone are the days when tumbling was only used as a means of removing burrs, scale, etc. Now intricate parts are barrel finished with EXOLON the fast-cutting, long-life abrasive that is barrel finished itself for non-scratch precision smoothing of metal surfaces.

Exolon Tumbling Abrasive is produced from solid fused aluminum oxide and its abrasive characteristics are closely controlled during manufacture in the electric arc furnaces.

Let us barrel-finish some parts for you, or we will be glad to send you trial lots of Exolon Barrel Finishing Abrasives. You will find that Exolon gives you a superior finish at substantially lower costs. Write for complete information.

Export Representatives—Gerard Kluyskens Company



THE EXOLON COMPANY 1002 East Niagara Street, Tonawanda, N. Y.

Manufacturers of Silicon Carbide and Aluminum Oxide Abrasives

Use postpaid card. Circle No. 214

EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- *Open-side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Controls*
- *Low Pressure Hydraulic System*
- *One-Shot Lubrication System*
- *Adequate Safety Devices*

BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18", 24" and 30" with table lengths from 5 to 20 ft.

18" x 24" x 204" HILL Vertical Spindle Open-Side Hydraulic Surface Grinder. (Also built in Horizontal spindle design)

THE HILL ACME COMPANY

1201 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

Use postpaid card. Circle No. 215

The Editor's Page

Those Russian Engineers

Never underestimate the other fellow; don't overestimate him either. And it appears that we are attributing more weight to recently published figures on Russian engineers and scientists than the facts warrant. We do not belittle Russia's efforts, nor do we imply that all's well with the world so let's stick our heads back into the sand.

What is an engineer?

Without embroiling ourselves amidst the whirlpools of definitions and semantics, the question is important in evaluating statistics on Russian engineers. We have talked with many people who have been to Russia and looked into the engineering situation. Here is a summary of their findings: The Russians are curious about all mechanical matters, they are adept technically and mechanically. We must disabuse our minds of the picture of a plodding, stupid peasant who was but one grade above an animal; the Russian mind is eager and keen at grasping technical details.

It must be remembered that all engineering students are given additional benefits by the state, resulting in many students choosing engineering knowledge; they become the dull tools of engineering. Yet, they're counted as engineering students.

Under "engineering" in Russia everything is lumped indiscriminately: A worker in a utility is an Electrical Engineer; a railroad dispatcher is a Transportation Engineering, a grinding wheel inspector is an Abrasive Engineer, and so on, without end.

Now we come to other types of engineers: A tailor is a Textile Engineer, a farmer an Agrarian Engineer, a house painter becomes an Engineer of Visual Presentation, a man who raises flowers becomes a Potted Engineer. It all seems a bit silly to us, but according to those who've been to Russia this is no exaggeration. We tend sometimes in the same direction in this country with our titles: A salesman is a Sales Engineer, an advertising agency performs an Advertising Engineering Service, the guy who cleans your furnace is a Heating Engineer. Mull over these, Time Study Engineer, Maintenance Engineer, Technical Engineer, Purchase Engineer. Before anyone takes us to the Cleaning Engineer let us hasten to point out that there are a few such engineers as we've listed. They're competent, doing a fine job, and no disrespect is intended; we dare say they will be the first ones to agree with us that the phonies should be tossed to the Garbage Engineer and true engineering titles be restored to their rightful owners.

Too many people are trying to play on the prestige of the engineering title, the Russians are not better in that respect than many people in this country.

After all is said and done we take Russian statistics with a shaker full of salt; which doesn't alleviate the misuse of engineering talent in this country nor does it lessen the need for more scientists and engineers.

Wm. J. Schleicher

Editor

THE MOST AUTHORITATIVE source of information on safe grinding wheel use, care and protection is the American Standard B7.1-1956 Safety Code. New informative approach to presenting the code regulations make them easier than ever to follow.

NEW CODE: Key to Safe Grinding

Four years' patient work on the new American Standard grinding wheel safety code has produced the most usable revision in the code's history. Here are the improvements which have been made.

● On October 26th, the American Standards Association approved the latest revision of the Safety Code for the Use, Care, and Protection of Abrasive Wheels. Officially known as ASA B7.1—1956, this newest version of American industry's Bible of safe grinding wheel practice is a marked improvement over the 1947 code in size, arrangement and content. It's probably the biggest change to occur in the published code since the first edition in 1917.

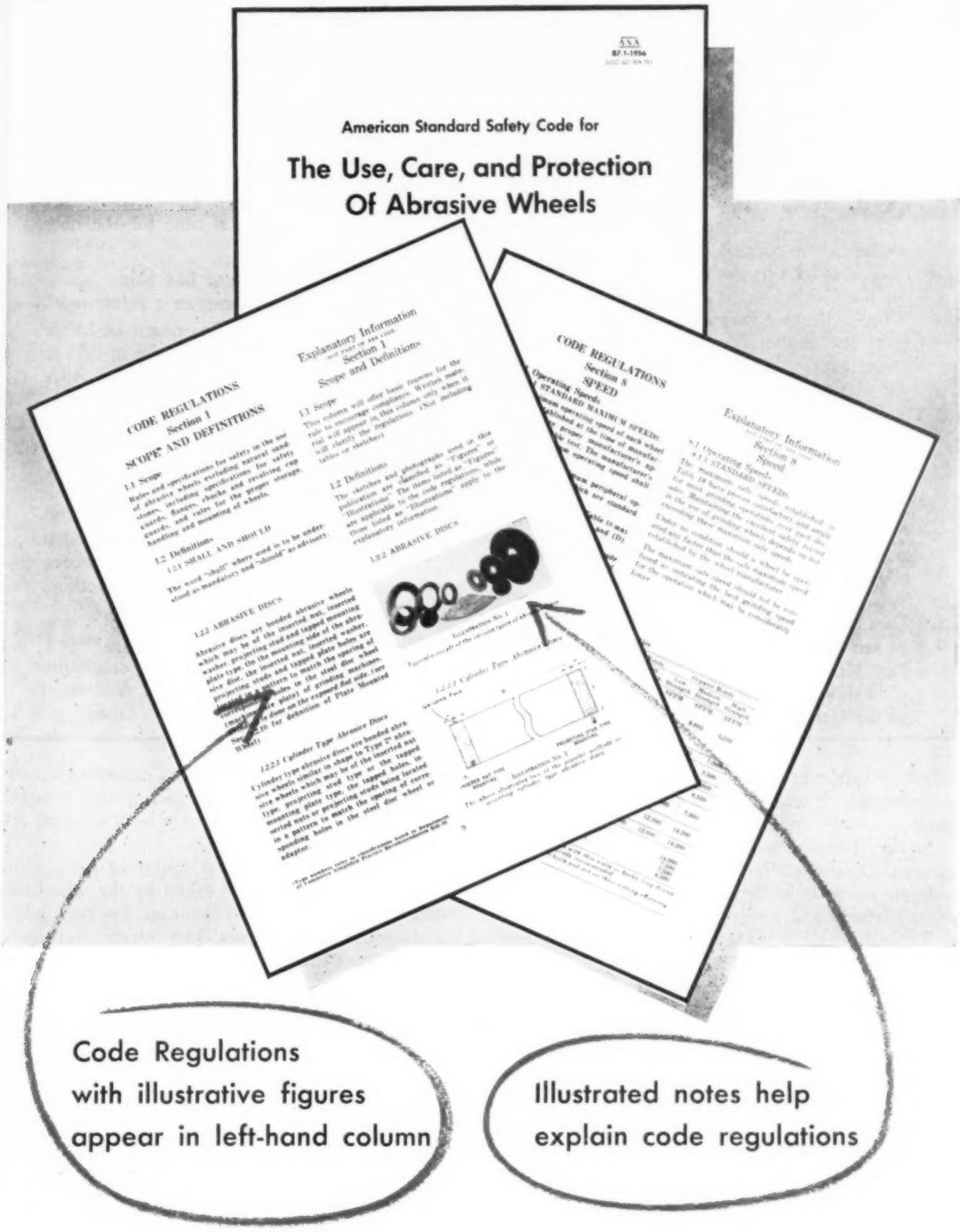
Changes in Appearance

The new size of the Safety Code—a standard 8½ by 11 inches—will make it easier to file or bind. But the most striking change is in the format or arrangement of the code regulations.

As shown in our illustration, code regulations now appear in the left-hand column of the new two-column format. These regulations are printed in distinctive bold type. Drawings and other pictures which are a part of the code are designated as Figures.

Appearing alongside the code regulations on each page is an explanatory column which hasn't previously been a part of such codes—in fact, the B7.1—1956 code is the first standard to use this form of presentation. The explanatory column, in a lighter type, is intended to show the reasons behind each code regulation, and to help users of the code in applying the regulations.

When questioned about the new format of the code, R. N. S. Merritt of Norton Company, secretary of the sectional committee which compiled the re-



vision said, "We're sure the new manner of presentation will encourage compliance of all those who work with grinding wheels. Even though the explanatory material isn't an official part of the standard, it will make the code much more usable."

Changes in Content

Technically speaking there wasn't too much wrong with the old 1947 code, but it needed clarification and explanation, which has been accomplished by the new two-column arrangement. There have been

What is an American Standard?

An American Standard defines a product, process or procedure with respect to its nomenclature, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, certification, testing or the service to which it is designed. It implies a consensus of those who are vitally concerned with the topic it covers. In the case of the Safety Code for the Use, Care, and Protection of Abrasive Wheels, the people most concerned were the users and manufacturers of grinding wheels. Sponsors of the new code were the International Association of Governmental Labor Officials and the Grinding Wheel Institute, which is composed of grinding wheel manufacturers.

Who writes American Standards?

A "Sectional Committee" prepares the new standard or its revision for publication. For the revised grinding wheel safety code, the Sectional Committee represented nineteen nationally recognized Engineering, Safety, Abrasive Wheel and Grinding Machine Fabricator and User Associations, Labor Organizations, Underwriter Groups and several Governmental Agencies. Much of the credit for drafting the new code should be given to the Safety Committee of the Grinding Wheel Institute, according to R. N. S. Merritt, secretary of the Sectional Committee. Writing the Standard and getting it approved by everyone on the Sectional Committee is a complicated process because of the many interests represented. That accounts for the four years' preparation time for the new B7.1 code.

Does an American Standard like this become adopted by all states as a safety law?

So far, it hasn't. The Department of Labor took a close look at state safety codes in 1953 to see how they compared with the 1947 ASA grinding wheel code then in effect. The study revealed the need in most states for stronger safety laws. For example, twenty states did not have abrasive wheel codes or standards of any kind, and only nineteen states had codes partially covering the ASA Standard. Nine states and the District of Columbia had codes or standards equivalent to the ASA Standard. The new code could go a long way in improving this situation.

Where can copies of the new grinding wheel code be obtained?

The Grinding Wheel Institute distributes copies of the code free of charge. Address is 2130 Keith Building, Cleveland 15, Ohio.

advances in the quality of grinding wheels and the introduction of some new types of wheels and accessories made some text changes necessary.

Section 1, Scope and Definitions, has been rearranged. Definitions have been added for new developments such as depressed center wheels, reinforced wheels and revolving cup guards.

Table 1, dealing with spindle diameter requirements, has been revised and expanded to make it more useful to the machine designer. The section on protection devices now covers the very popular revolving cup guards used on portable grinders. The regulation specifies for these a peripheral member outward from the back for 1/3 of the wheel thickness. In using the revolving cup guard, the clearance between wheel and guard shall not exceed 1/32 inch to insure optimum protection.

The code gives information on the fabrication of drawn steel guards for portable grinders.

Speed Tables

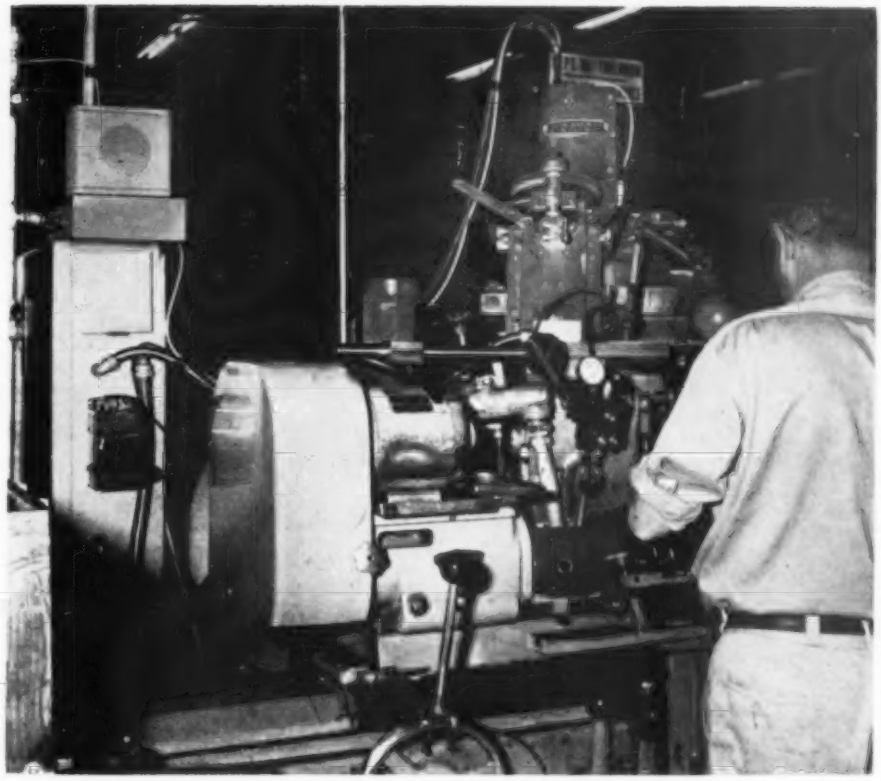
The speed tables have been rearranged and extended to cover new types of wheels. The old speed table has been broken down into two tables, one labeled "Standard Maximum Speeds" and the other for "Special Maximum Speeds." Maximum speeds have been established for two new classes of wheels, the "reinforced" type and the "depressed center" type. The conditions under which grinding wheels may be run at high speeds have been clarified and strengthened.

In the section on general operating rules, a discussion of the steps to be taken by the wheel user after an accidental wheel breakage has been added in the explanatory column. This information should help prevent the recurrence of grinding wheel accidents.

Section 10 on mounted wheels has been changed to aid users in mounted wheel application. The old "critical speed" tables have been replaced by easy to use "maximum speed" tables.

Summary

Adherence to the American Standard code will go a long way toward the prevention of grinding wheel accidents, depending on how faithfully the code regulations are carried out. Sponsors of the code have done a superb job in presenting it in a package that's easy to use and very educational to the user. Time alone will tell whether users will take advantage of the code provisions to make their shops safer, and whether our state legislative bodies will pass workable safety laws based on the new American Standard. ● ● ●



HI-FI PICKUP on Norton automatic wheelguard dresser, right, feeds signal through light-colored lead to amplifier-speaker unit at left to tell operator how he's doing.

Hi-Fi in the Grinding Room

Johnson Motors' grinder operators can now listen to their dressing tool at work, by means of a hi-fi rig attached to the machine dresser. Gives close control of dressing even in noisy shop location. Total cost: about $125.

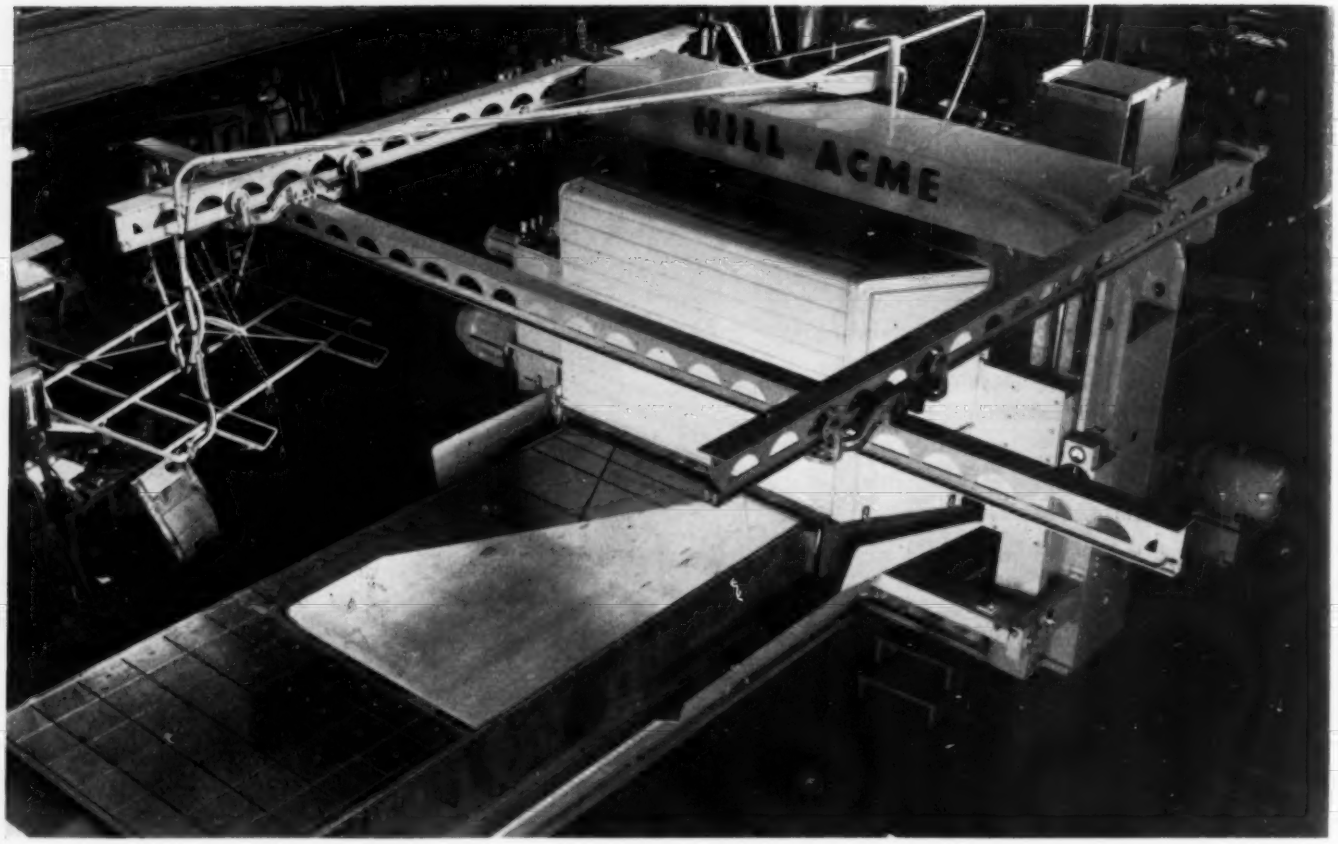
• When it comes to grinding wheel dressing, the grinder operators at Johnson Motors in Waukegan, Illinois "play by ear." Like many experienced grinders, they listen to the dressing tool during its pass across the wheel. The sound tells them when the wheel has "sparked out," indicating a properly dressed wheel. However, at Johnson they have added Hi-Fi electronic equipment to amplify the sound above the other sounds in the area to eliminate guess work.

This equipment has been mounted on two Norton 6-inch Angular Wheel Head grinders used to plunge grind the thrust face and bearing diameter on spiral gears used in the famous Johnson Sea Horse outboard motors. The wheels are dressed with a sixty degree angle on the side and thirty degrees on the face. Dressing is accomplished by means of an automatic wheel guard truing device.

The Hi-Fi equipment consists of two sensitive crystal pick up units, one mounted on the dresser slide of each machine; a five watt amplifier (Hi-Fi) and a speaker. The amplifier and speaker are mounted in a cabinet to the rear and between the machines. Total cost of the component parts was $34.14. Assembly and installation costs came to about $90.

Two Johnson men, Leonard Presnell and Rubin Medeen, originally saw this idea in use at the George Gorton Machine Company in Racine, Wisconsin. They brought back the details and installed the system in their own plant.

According to them, the use of sound amplification in industry offers many possibilities in fields other than wheel dressing. For example, such equipment could be used to actually hear a part seating against a shoulder in an assembly operation or used as an indication of load or volume where sound is a constantly relative factor. • • •



AN INTERESTING TEST ON ALUMINUM tapered skin grinding. Water-proof cloth belt, 86-in. x 138-in., silicon carbide was used. All tests were conducted with the identical belts.

At a through speed of 11 fpm and cutting at a depth of .010-in., the following work was done with one belt:

1. Four full plates were ground on both sides for a trial of .052 in. per plate.
2. Four plates were ground on one side for a total of .050-in. per plate.
3. One plate was taper ground for a total of .170-in.

The following results were obtained with the second belt:

1. Three plates were ground for a total of .050-in. on each plate; depth of cut was .010-in. at 11 fpm.
2. A taper was ground on one sheet using the following steps:
   a. first cut, .020-in. at 6½ fpm;
   b. second cut, .040-in. at 6½ fpm;
   c. third cut, .100-in. at 1 fpm.

While taking the .100-in. cut 60 per cent of the full load was being drawn on a 250 hp motor, or 150 hp. The belts were apparently undamaged. In the top photo the machine is shown with the plate in position for grinding. The frame shown at the left in the photo above is a loading apparatus employing suction cups. Below left: the huge belt is being installed in a Hill Acme machine.

If you're

Grinding Aluminum . . . .

these fundamentals may help

The grinding of aluminum has been considered a tricky business at best; wheel loading, undue heat and inferior surface finishes were major complaints. However, much research has gone into the grinding of aluminum and many companies have discovered answers to most of the problems. A review of basic fundamentals may be of interest.

DATA THROUGH COURTESY OF KAISER ALUMINUM

● For roughing aluminum use a fast table traverse and a peripheral wheel speed of 8000-9000. For finishing, slower speeds of about 6500 are satisfactory. As the wheel diameter decreases the rpm should increase proportionately. Because many variables are encountered in the grinding of aluminum, speeds

cannot be rigidly set; for instance, if a wheel acts too soft the speed can be increased to obtain a harder action. However the speed is regulated, care must be taken never to run the wheel beyond the speed set by the manufacturer.

Observing the recommended speeds for a wheel is important not only from a standpoint of cutting action and final production but also as a safety precaution. The stresses from centrifugal forces increase as the velocity is raised. The force tending to pull a wheel apart will be four times greater with a wheel operating at 3600 rpm than with the same wheel operating at 1800 rpm.

As a wheel wears, or when smaller diameter wheels are used, surface feet are less, even though the rpm remains the same. (Surface feet is the distance in feet any one abrasive grain on the cutting face travels in one minute.) As the wheel wears down the rpm must be increased, and as long as the original surface speed isn't exceeded this is a safe practice. For example: a 20-in. wheel turning at 1146 rpm is running at the rate of 6000 sfpm; when the same wheel wears to 13-in. it has dropped 35 per cent to 3900 sfpm.

Tables showing maximum wheel speeds are classified in surface feet per minute. Machine, spindle speeds are generally indicated in revolutions per minute. Here are the formulas for finding rpm and sfpm.

rpm = 12 x sfpm divided by wheel diameter x 3.1416

sfpm = wheel diameter x rpm x 3.1416 divided by 12

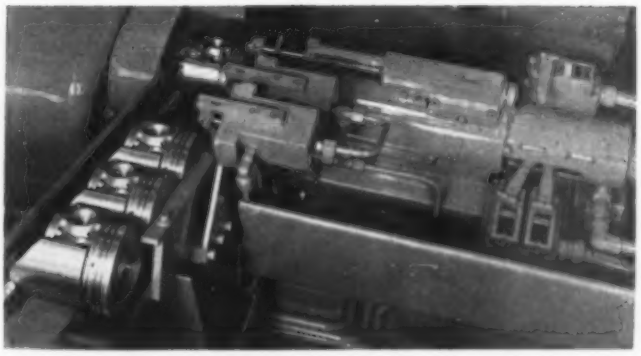
sfpm = .292 x diameter in inches x rpm

It must be remembered that running a wheel at maximum speed does not mean higher production or better work. A manufacturer when grinding flash off a casting noticed a drop in pieces per hour. A check revealed that the 30-in. resinoid wheels were only producing six pieces per hour. There was some wheel breakage. A check revealed that the rpm had been increased inadvertently to 1500 rpm. With a 30-in. wheel this meant an sfpm rate of 12,000, far above the maximum safe speed rate set by the manufacturer. When the rpm was dropped to 1000 wheel breakage stopped and production increased to eight pieces per hour.

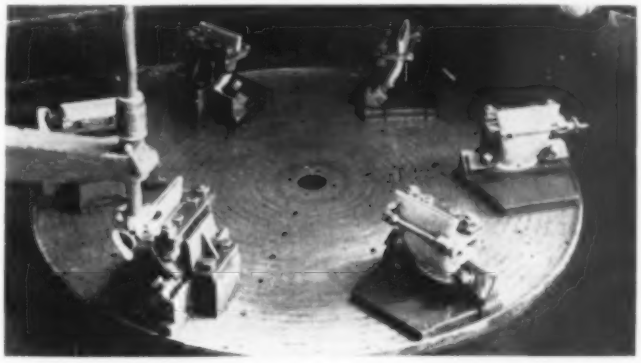
Wheels in Grinding Aluminum

Proper grain and grade of grinding wheels used in aluminum are very important. If too coarse, they leave a poor finish; if too fine or too hard, they clog, or glaze, causing overheating. When too soft, they wear too rapidly.

For grinding aluminum a free cutting silicon carbide in a flexible base is generally preferred. Aluminum oxide is not recommended except in certain abrasive belt applications and cutoff wheels. The wheels of medium hardness of about 30 grit in a

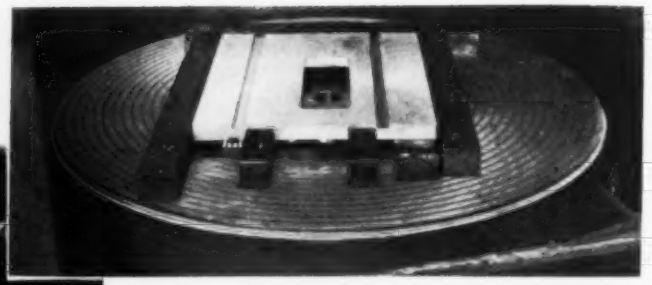


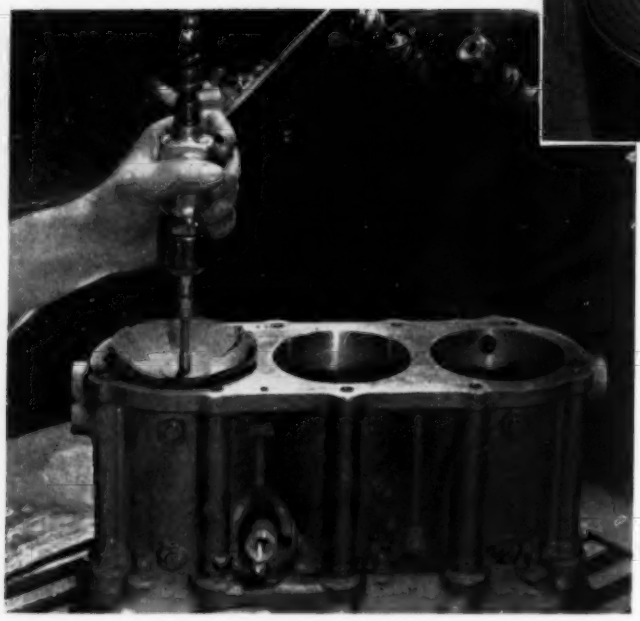
H-41 5-in. x 8-in. TYPE H AUTOMATIC PISTON GRINDER with automatic loader and ejector. Cam grinding the skirts of pistons. Stock removal is .015-in. and production is 115 pistons per hour. Two operators tend a battery of 12 machines.



HOLDING SMALL ALUMINUM "CLAMSHELLS" for grinding two ends. Six pieces are held in fixture on a 36-in. magnetic chuck for grinding small end and 14 are held for grinding large end. Feed is .020-in. per minute. Chuck speed is 12 rpm. Stock removal is 1/16-in. One hundred pieces, or 200 surfaces, are finished per hour.

THESE FRAIL ALUMINUM CASTINGS must be machined flat and parallel on top and bottom surfaces to a commercial finish. Part is held by straps to a steel plate which is held to the magnetic chuck. Shims are used as needed under the rough casting, at the straps, when grinding first surface. First operation establishes two flat and parallel surfaces from which all later operations locate. Stock removal per side is 5/32-in. Parallel limit is .0015-in. Two pieces, or four surfaces, per hour.





AN ALUMINUM SAW TABLE area is ground on a 36-in. chuck and held entirely by steel blocking on the magnetic chuck. Second operation on reverse side of table grinds four bosses parallel to the broad face. These are ground by blocking two tables against the outer chuck ring and using side blocking to hold tables. Stock removed is 1/16-in. per side to a flat limit of .004-in. Production is 8½ pieces, or 17 surfaces, per hour.

SLOTTED DISCS RAPIDLY FINISH the inside walls of a 3-bore aluminum throttle body. The slots in the discs permit the segments to overlap and centrifugal force holds the cutting surface against the work.

synthetic resin bond have been found to work most successfully in roughing work. For finishing, a finer grit, up to about 54, in a vitrified bond is popular.

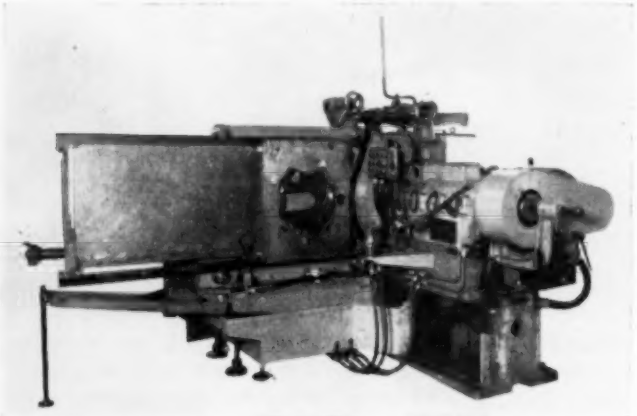
Because the silicon carbide is more brittle, the abrasive grits fracture readily in aluminum, thereby presenting a constantly changing, sharp face to the work.

What about the grinding wheel bond when grinding aluminum? Most frequently used are vitrified, rubber and resinoid. Because the physical properties of aluminum differ widely, as well as the kind of workpieces, finish required, tolerances to be held and machine to be used, it is almost impossible to make any recommendations here. It is best to consult the manufacturer for specific recommendations.

The Grinding Wheel Institute has compiled a selection chart which should be used cautiously because of the many variants inherent in any grinding operation; however it may serve as guidepost and starting point for selection.

Operation	Abrasive	Grain Size	Grade	Bond
Cylindrical	C	36	K	V
Surfacing (cups & discs)	C	24	J	V°
Surfacing (discs)	C	20	K	B
Internal	C	36	K	V
Floor Stands, 5000-6500 sfpm	C	24	O	V°
Floor Stands, 7000-9500 sfpm	C	24	P	B°
Portable Grinders, 5000-6500 sfpm	C	24	O	V°
Portable Grinders, 7000-9500 sfpm	C	30	O	B°
Cutting-off (Dry) 9000-16,000 sfpm	A	24	—	B
Cutting-off (Wet) 7500-12,000 sfpm	A	46	—	R
Cutting-off (Tabor Foundry Machines)	A	24	—	B

° Treated
—Consult Wheel Manufacturer



A DOUBLE HORIZONTAL SPINDLE disc grinder with power-driven reciprocating unit. The part is a torque converter adaptor plate and has .012-in. stock removed from each parallel side. Flatness is within .002-in. and parallel within .001-in. Production is 180 pieces per hour.

For grinding aluminum a free cutting silicon carbide in a flexible base is generally preferred. Aluminum oxide is not recommended except in certain abrasive belt operations and cut-off wheels. Wheels of medium hardness of about 30 grit in a synthetic resin bond have been found to work most successfully in roughing work. For finishing, a finer grit, up to about 54, in a vitrified bond is popular.

Cutting-off With Abrasive Wheels

For clean cutting work on aluminum billets, bars, extrusions, etc. an abrasive wheel frequently out-

performs a hack saw. These cutting-off wheels are usually of aluminum oxide. If the operation is done wet, which is generally recommended, the bond is usually rubber, and either rubber or resinoid bonded when used dry. Typical specifications are aluminum oxide, 20 grit, U hardness, 6 density, rubber bonded; aluminum oxide, 24 grit, S hardness, 7 density, resinoid bonded.

Width of the wheels range from .003-in. to .156-in. Diameters vary from 1 to 30 inches. Such wheels cut to within a few thousandths of an inch.

A typical specification for an abrasive cutting wheel used in aluminum bar stock is a silicon carbide-aluminum oxide combination, 24 grit, S hardness, 6 structure, resinoid bonded.

For wet cutting of intricate extrusions, a recommended specification is silicon carbide or aluminum oxide, 46 grit, S hardness, 7 structure, rubber bonded.

The cutting off of gates and sprues from castings of difficult, irregular shapes is another high production operation using abrasive cut off wheels. Suited for this type of work are the new reinforced flexible wheels. They possess great strength and durability and their special construction permits high speed operation with safety. This also allows an amount of side strain or pressure without danger of breakage. Grinding is done on either side or the edge, simultaneously or singly. Such wheels have a long life and because of a resistance to loading they grind clean and fast. A typical specification for the grinding of aluminum is silicon carbide, 24 grit, O to U hardness, 14 density, and resinoid special bond.

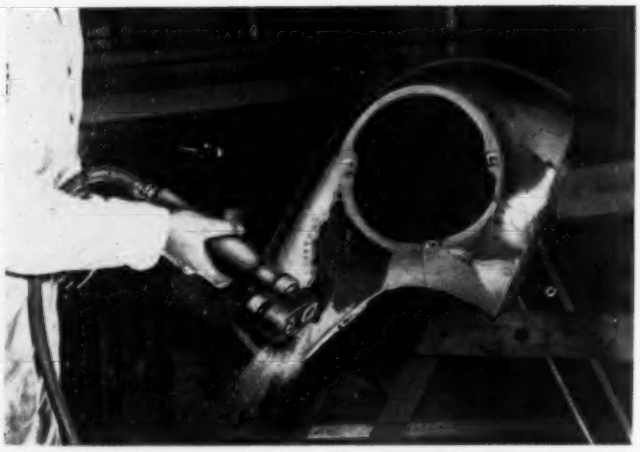
Coolants and Lubricants

Special lubricants must be used. At one time straight kerosene was used but this made a very unsatisfactory condition for the operator as well as creating a fire hazard. The addition of carbon tetrachloride removed the fire hazard but failed to remove the unpleasant operating conditions. At the present, most oil companies, coolant manufacturers, and some machine tool builders have soluble oil solutions that have proven very satisfactory for the grinding of aluminum. A neutral solution is recommended. Water mix grinding fluids such as soluble or emulsifiable oils stay in solution without much trouble unless the water is unusually hard. Addition of a wetting agent is sometimes helpful and in any event, the water should be agitated thoroughly as the mixing is being done. Although emulsions of about 35 to 1 are common, a better cushioning effect, that also prevents a tendency to clog, is often obtained from a much lower ratio. One midwest manufacturer, in grinding soft castings, went progressively from a 20 to 1 mixture to a 6 to 1 before obtaining satisfactory results.

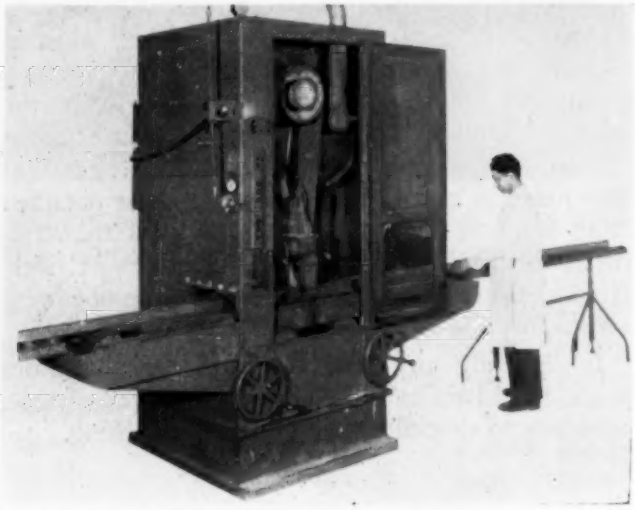
In selecting any grinding fluid for aluminum work, consideration should be given to performance, tendency to rancidity, gumming and foaming.

ANOTHER INTERESTING INSTALLATION on the grinding of extrusions is this conveyorized belt machine. Parts move through the machine and under a belt. Bars, rolls and narrow sheet and plate aluminum are ground in this unit. ——→

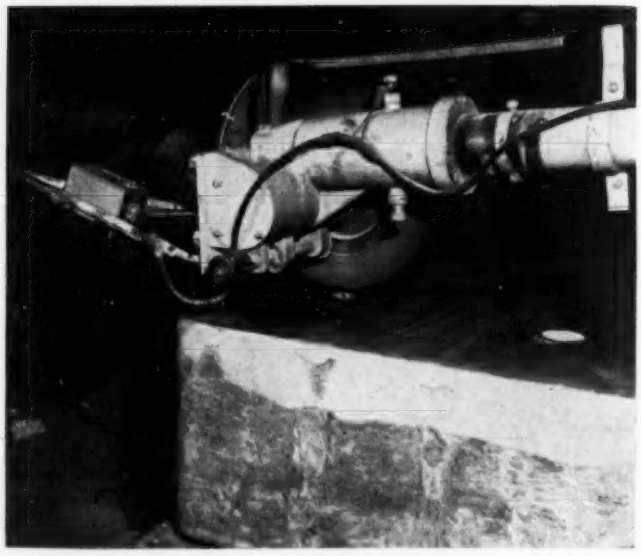
CLOTH PENCILS—small cartridge rolls of abrasive cloth—are made in several lengths and diameters. Other shapes, mounted on arbors, are sections of sandpaper coiled to a point and cone-shaped sleeves. These allow operator to reach odd-shaped spaces or corners.



A HANDY DEVELOPMENT is this attachment designed to fit the majority of air or electric grinding units. It utilizes a small abrasive belt 12 x 1-in., or 20 x 2-in. Attachments are light, fast cutting and relatively chatter free.



GRINDING THESE LONG EXTRUSIONS is frequently a problem. One manufacturer, using an abrasive belt machine, eliminated a half dozen backstand operations formerly needed to meet production requirements. Surfaces obtained with 120 to 400 grit abrasive belts are suitable for anodizing.



REMOVING FLASHING from aluminum control boxes with a swing grinder using an aluminum oxide, 36 grit, resin bond, abrasive belt. For grinding portions of the boxes that cannot be reached by the swing grinder, a portable grinder, employing 24-grit, aluminum oxide discs is employed.

Straining the circulating coolant before it is returned to the work will give better finishes.

In rough grinding, where stock removal is the primary objective, generous applications of wax or stick grease in various grades are often satisfactory. This type of lubricant is often resorted to when the application of liquids is impractical.

Due to the high coefficiency of thermal expansion of aluminum, heat distortion is frequently a danger. This is especially true when grinding between centers. Not only will adequate coolant prevent excessive heating of the workpieces, but it will also aid in carrying off grinding particles of metal and abrasive, resulting in better surface finishes.

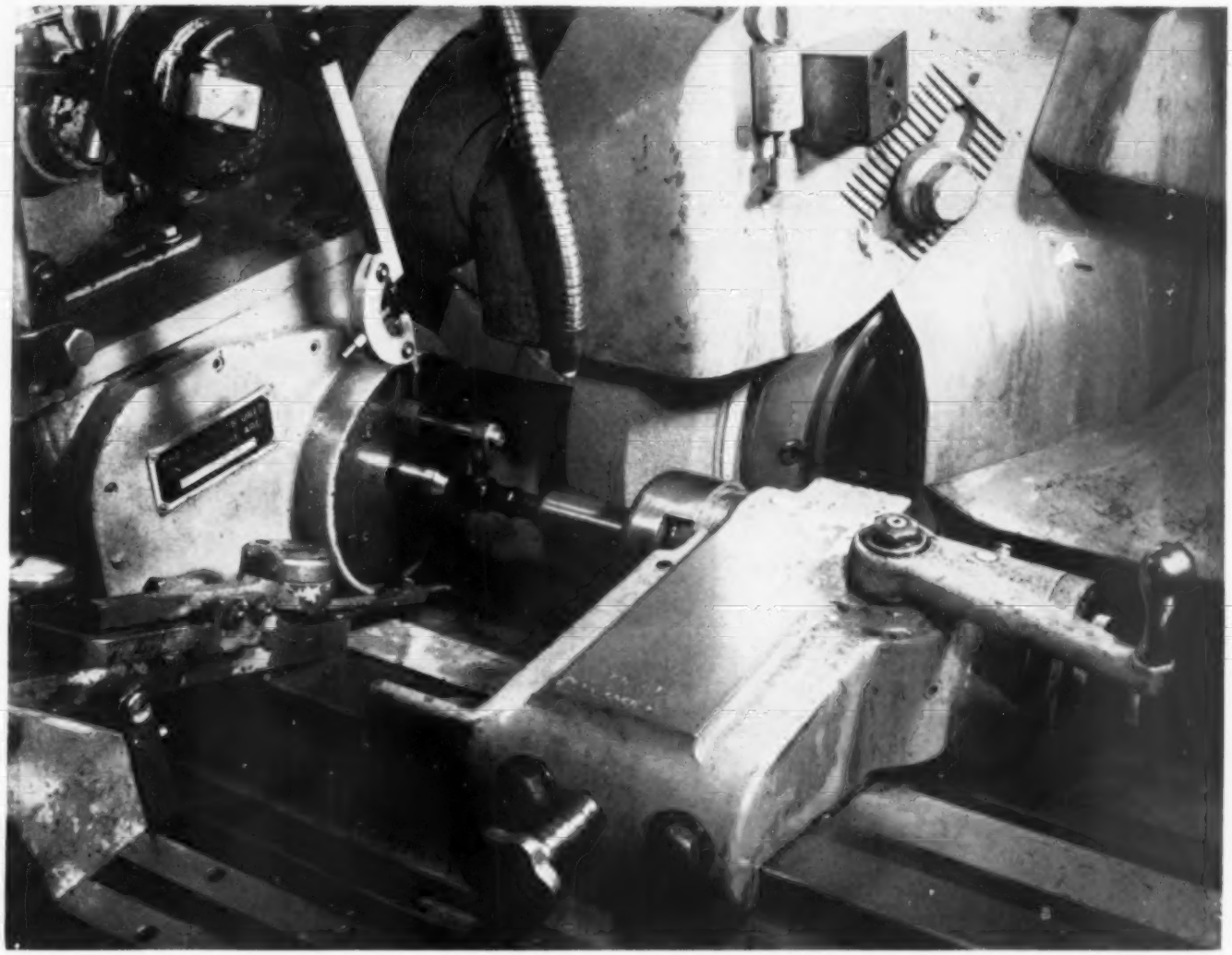
Lubricants and Coolants for Abrasive Belts

Lubricants improve the finish produced by a coated abrasive belt and prevent glazing. These range from stick waxes to water. Standard cutting oils and water soluble oils are often used in production type belt machines. Greases, by settling between abrasive grains and cushioning the penetrating action of the abrasive into the work, produce finer finishes than dry grinding. In this way, the crest of each grain is free to cut, but deep scratches are prevented by the lubricant.

Fluid lubricants are used primarily to prevent belt glazing. This action is required in grinding aluminum. Water is often employed but should be used with a rust inhibitor to protect the machine. Greases are used with abrasive belts for offhand grinding of aluminum die castings. Grease sticks are available in viscosity graduations from light to heavy. For grinding jobs where stock removal is the primary objective, light greases should be used. Light greases prevent the belt from loading but permit a maximum amount of abrasive penetration into the metal being ground. Where good finish is the objective, heavy greases should be used. Many actual operations are today using two types of grease side by side on the same abrasive belt. One side is used for a high rate of stock removal and the other side, for a finer finish. If the belt becomes loaded despite the use of grease, an application of kerosene will cut the grease and thus free the belt of embedded particles.

A soluble oil mixture is highly effective in grinding aluminum if stock removal is the primary objective. The soluble oil mixture retains the coolant properties of the water, frees the belt of particles, improves the finish, and protects the machine's exposed parts. The integral coolant system of the machine keeps a copious flow of the mixture on the belt.

In mixing soluble oils with water, the directions of the supplier should be adhered to. An oil recommended for soft water may be totally unsatisfactory for hard water without softening additives. No single grade or mixture serves all purposes. • • •



PLUNGE GRINDING holds the OD and shoulder of this small 4340 steel gear within .0003-inch in an automatic infeed cycle operation at GE's West Lynn plant. Grinding wheel is at a 30° angle with the work.

Gear Shaft Grinding

An interesting case history from GE's Aircraft Accessory Turbine Department. Close work of this kind requires careful wheel selection, attention to every operation detail.

by **D. D. Baldwin**
Abrasive Engineer
Simonds Abrasive Company

● An interesting grinding operation is performed on aircraft gear shafts at General Electric Company, West Lynn, Mass. The gear shaft is a compound of an air turbine-driven hydraulic pump, one of several which generate the hydraulic power to actuate bomb-bays, landing gear, wing spoilers, and other components of the Boeing B-52.

The gear is part of a train which reduces the turbine wheel speed of 37,500 rpm to 3700 rpm, the speed of the constant speed variable displacement pump. The gear is about 1" in diameter and ½"

New CATALOG
WM. SOPKO & SONS CO.
GRINDING WHEEL ADAPTERS
AND TOOLROOM ACCESSORIES

finest quality ADAPTERS

- Precision-made, Hardened and Ground with Heat Treated Nuts
- Complete Line—4 New Models Available
- For Use on All Popular Surface Tool and Cutter Grinders
- Large Stocks—Immediate Delivery

USE SOPKO ADAPTERS—SAVE TIME, TROUBLE AND MONEY

WM. SOPKO & SONS CO.
140 E. 267th ST. • EUCLID 32, OHIO

Please send your New Free Illustrated CATALOG

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

Use postpaid card. Circle No. 216

thick. The shaft is .6694″ in diameter with a splined center hole. Gears are made of 4340 steel which has been induction hardened to 53-55 RC.

The wheel used for the OD-and-shoulder operation is a Simonds JA60-M5-V1, 24 x 2 x 12, with an "N" face, "X" dimension ¾″, "V" dimension 60°.

The grinding machine is a Norton 6 x 18 angular slide grinder with the grinding wheel at an angle of 30° with the work to be ground. This allows the wheel to come in for very close shoulder grinding without using a dished wheel. The grinding wheel is driven by a 25 HP motor, the work by a 3.5 HP motor, and the hydraulic system and coolant are powered by a 2 HP motor. The grinding is a plunge cut with controlled infeed in an automatic cycle, adjusted according to the amount of stock to be removed. Flanges are 14″ in diameter and are relieved. Balancing accomplished by using a balancing stand and adjusting balance weights in flange. The wheel head motor turns at 950 rpm, with a work speed of 314 rpm. In-feed is .001″ every 2.5 seconds. Dressing is done by a cluster diamond tool used in the automatic hydraulic dresser.

Coolant used is Van Straaten Vantrol No. 225, mixed 40 to 1. Filtering is done by settling tanks.

Approximately .013″ stock is removed from the journal and shoulder of the gear shaft. A .010-.020″ radius at the junction of the shoulder and journal must be held. In some cases this is held to a maximum of .012″. Although the total operating cycle must be set for 110 seconds which allows for distortion and variation in stock size, actual grinding time is approximately 20 to 30 seconds. During the 110 second cycle, the grinding head is advanced, the work is ground to within .0003″ total tolerance, the wheel head is retracted and coolant is shut off.

Dressing is done every 7 pieces because of wheel breakdown at the shoulder radius. This is done automatically, the in-feed mechanism compensating for dressing. Wheels are discarded at approximately 16″.

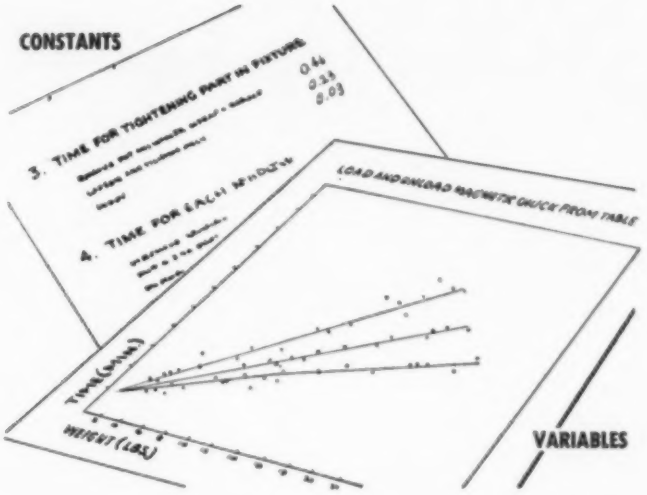
Since grinding proceeds automatically, it is only necessary for operator to place gear in machine, start the cycle and then remove piece when cycle is finished. He checks finished part with a snap gauge and checks radius at shoulder with a comparator. Operator advances hand wheel to compensate for wheel wear after checking size. • • •

help your HEART FUND help your HEART

Developing

Standard Time Data

for Grinding Operations



Part 5—Conclusion

Center Lapping

by **E. A. Cyrol**

E. A. Cyrol and Company
Management Consultants

Final part of an authoritative series on standard data for grinding. The author has outlined the method by which standard data can be developed for any grinding operation. Previous articles in this series have featured standard data studies for Blanchard surface grinding, center-type cylindrical grinding, and infeed centerless grinding.

Element Description

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

1. Pick Up Piece to Center: 0 to 5 lbs. 0.31
Over 5 lbs. See Table I, Work Sheet

This element includes the time allowed for the operator to pick up a piece from skid or tray to machine center, approximately 24 inches distance.

2.. Position Piece on Center: .023

This element includes the time allowed for the operator to position piece on center to prepare to lap.

3. Reverse Piece on Center: .026

This element includes the time allowed for the operator to turn piece 180° on center to prepare to lap opposite end.

4. Remove Piece from Center: .018

This element includes the time allowed for the operator to remove piece from center after both centers have been lapped.

5. Aside Piece: 0 to 5 lbs. .029
Over 5 lbs. See Table I, Work Sheet

This element includes the time allowed for the operator to aside piece to skid or tray, approximately 24 inches.

Weight	Pick Up	Aside
o# - 5#	.030	.029
5.1# - 10#	.059	.041
10.1# - 20#	.073	.051
20.1# - 50#	.093	.068

CHART NO. 21—PICK UP AND ASIDE PIECE, center lapping.

Center Lapping

Wheel Dress Allowance

Dress Wheel and Wax—.360

Regular Center Hole	.012	One dress per 30 pc.
2 Centers of Same Size	.024	One dress per 15 pc.
Splined Hole	.036	One dress per 10 pc.
Thin Wall	.036	One dress per 10 pc.
.125 Center Hole	.036	One dress per 10 pc.

Regular Center Hole is used where center hole is of a solid nature, or a regular hole centered.

2 centers of same size—used when lapping two center holes of same size on piece.

Splined Hole is used when spline inside bore of piece shows up in center hole.

Thin Wall is used when center hole has a thin wall.

.125 Center Hole is used when a center is small (has a diameter of .125 or smaller).

Personal and Unavoidable Delay

The following allowances are to be added to the cycle or floor time of operations. The unavoidable delay allowance was determined from delay study observed on floor, and also from a check with an I.B.M. sheet of a week's run. The personal time allowed is shown below. The total is expressed as a percentage of the work day. It is determined by adding the total delay minutes allowed and subtracting from 480.00 minutes. The total minutes allowed is then divided by the remainder for the percentage figure.

Diameter of Center		Time to
Over	Thru	Lap
	.125	.050
.125	.250	.060
.250	.500	.070
.500	1.375	.080

CHART NO. 22—CENTER LAPPING TIME.

Personal: **33.00 Min.**

The personal time allowed is as follows:

1. End of shift wash up..... 7.00 Min.
2. Two coffee periods (5.00 Min. each).....10.00 Min.
3. Personal .....16.00 Min.

33.00 Min. Total

Unavoidable Delay: **19.00 Min.**

These delays occur throughout the day and consist of receiving instruction from foreman, group leader, or set up man. Interference from or assistance to truckers and material handlers. Adding skid sections and cardboard separators. Arrange work at work area. Make adjustment on machine for length of piece in setting up. Change wheels. Punch and fill out time card.

Percentage Allowance:

Personal .....33.00 Min.
Unavoidable .....19.00 Min.

52.00 Min. Total

$$\frac{52.00}{480.0 - 52.0} = 12.1\%$$

Explanation of Work Sheet

A center lapping standard is calculated on the following pages through the use of the Standard Data Work Sheet.

When additional elements not included on the work sheet are found to be necessary, a time study should be taken to obtain this information. This element should be recorded in the write-up for future reference and development of Standard Data of this element.

Check files for finish print on part number concerned.

1. Fill in right hand corner of work sheet with Part Number, Operation Number, Part Name, Department Number, Description of Operation, and Size of Centers.
2. Enter values for Handling Elements in right hand column.
   a. For Pick Up and Aside of Piece refer to Table No. I on left side of work sheet. Enter values in column on right.
   b. Enter value given for Position of Piece on Center.
   c. For Lap Centers, refer to print for size center to lap, then refer to Table II on left side of work sheet to corresponding size center to

Center Lapping Standard Data Work Sheet

Table # I		
Weight	Pick Up	Aside
5.1#-10#	.059	.041
10.1#-20#	.073	.051
20.1#-50#	.093	.068

Lap Time Table II

Diameter		Time
Over	Thru	To Lap
	.125	.050
.125	.250	.060
.250	.500	.070
.500	1.375	.080

Wheel Allowance

Regular Hole..... .012
2 Centers of Same Size..... .024
Splined Hole..... .036
Thin Wall..... .036
.125 Center Hole..... .036

Part No. JA 12959 Operation No. 185
Part Name. SHAFT Dept. No. 738
Description of Operation. LAP CENTERS
Size of Centers. .375 & .469

Handling Elements.		
Pick up Piece to Center 0 - 5 lbs.	.031	.031
Pick up Piece to Center Over 5 lbs. See Chart		
Position Piece on Center	.023	.023
Lap .375 Center		.070
Reverse Piece on Center	.026	.026
Lap .469 Center		.070
Remove Piece from Center	.018	.018
Aside Piece to Skid 0 - 5 lbs.	.029	.029
Aside Piece to Skid Over 5 lbs. See Chart		
Wheel Dress Allowance		.012
Total Minutes Per Piece		.279
Personal and Unavoidable 12.1 %		.034
Total Production Time		.313
Plus 20% Adjustment		.063
Standard Minutes Per Piece		.376
Hrs. Per 100 Pieces		.627
Pieces Per Hr.		159.5

Previous Pieces Per Hr. 60
Previous Std. Hrs. 1.667
Computed By: GEORGE PHILLIPS
Approved By: Checked By:
Date Entered: 12-2-55 By:

get the time allowed to lap. Put value in column on right.

d. Enter value given for Reverse Piece on Center, only when both ends have centers to lap.

e. Enter value given for Remove Piece from Center.

f. For Wheel Dress Allowance, refer to Table III to corresponding type centers shown on print. Enter value in column on right.

3. Add up right hand column and enter total on "Total Minutes Per Piece" line.

4. Multiply above by 12.1% and enter time on "Personal and Unavoidable" line.

5. Add items 3 and 4 and enter total on "Total Production Time" line.

6. Multiply above by 20% and enter sum on "Plus 20% Adjustment" line.

7. Add items 5 and 6 and enter total on "Standard Minutes Per Piece" line.

8. Divide above total by .6 and enter time on "Standard Hrs. Per 100 Pieces" line.

9. Divide number 100 by item 8 and enter time on "Pieces Per Hour" line.

10. Fill in lower left hand corner of work sheet, item "Computed By," "Date," "Previous Pieces Per Hr." and "Previous Standard Hours."

11. Have standard checked by department supervisor and signed by foreman concerned.

12. Make out change slip and stamp with "Date Entered" and initial.

13. File standard for future reference.

End of series. Because of heavy reader response to these articles, our supply of tear sheets is exhausted, but the entire series will be available soon in reprint form. Watch for an announcement in this regard.

Big Barrels Speed Jet Output

Solar Aircraft has cut deburring time on J-57 jet vane-and-shroud assemblies by 75%. Fourteen assemblies at a time are fixtured in oversize barrels. Abrasive charge totals two tons per load!

● To speed production of complex stainless steel jet engine components, Solar Aircraft's Des Moines, Iowa, plant is using precision barrel finishing machines specially designed and built by Almco to deburr and smooth large precision assemblies.

Using the new automatic machines, Solar is completing the finishing operation on engine assemblies in one quarter of the time previously required, Bruce A. Willsey, plant manager of Solar-Des Moines, reported.

The new machines have a drum about six feet long and four feet in diameter. A fixed central shaft in the machine holds up to 14 of the Solar-built vane and shroud assemblies, which are major components of the J57 turbojet engine.

In use, the jet components are held rigidly on the central shaft, while the large tumbling barrel slowly rotates. The barrel's abrasive charge is a mixture of aluminum oxide chips, pieces of mild steel wire, and water. The vane and shroud units are intricate assemblies, consisting of inner and outer shroud rings connected by as many as 160 airfoil vanes.

The Solar tumbling units cost more than $50,000. In addition to the tumbling units themselves, the installation also includes a special conveyor system which hauls the abrasive charge to an overhead hopper, from which it is gravity-fed back into the tumbling barrel each time a new load of parts has been fixtured. The abrasive charge for each barrel weighs two tons.

In addition to the Supersheen oxide chips and soft steel diagonals being used as media, Solar is presently using four different compounds which perform the following operations in sequence:

1. Descaling
2. Grinding and burr removal
3. Cleaning
4. Rust inhibiting

The time cycle being used at present is approximately 2-½ hours for all four operations.

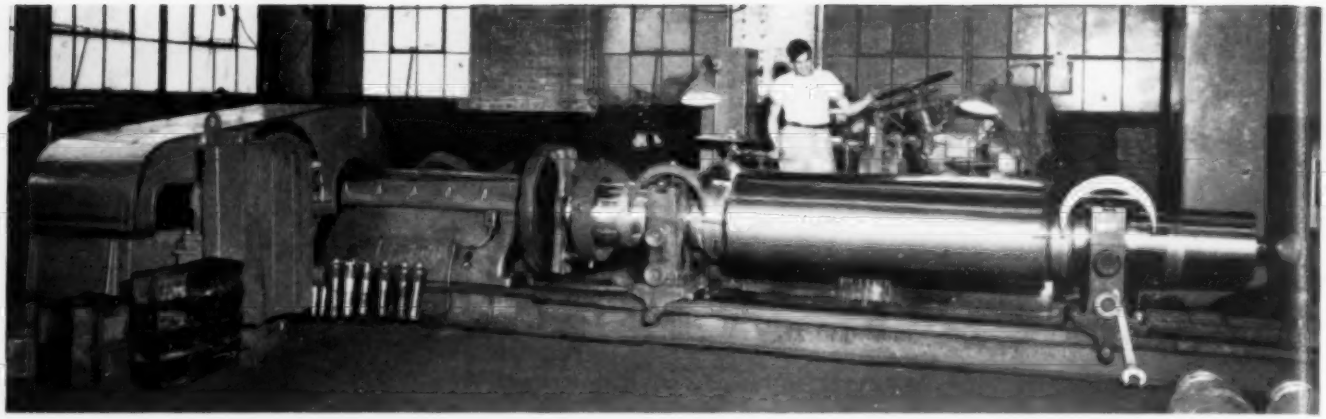
Solar's two machines are unique in that all handling of finishing media is performed automatically. This is accomplished by the use of hoppers located under each machine which discharge their compound, media and water to a vibrating screen. The screen allows compounds and water to pass through to a drain and vibrates the finishing media to the boot of a bucket elevator for transfer to the overhead hoppers. One bucket elevator serves both barrel machines.

Before Solar obtained the tumbling units, the vane and shroud assemblies were deburred by using hand air grinders, vapor blasting, and automatic wash cabinets. Often inspection after these operations would reveal remaining nicks or sharp edges requiring additional honing and polishing. One hour or more was required for the finishing cycle.

The new tumblers completely eliminate hand deburring, vapor blasting and wash operations, and are 75 per cent faster. Other advantages are less possibility of damage to the precise jet components; better mating of parts in the completed engines; better balance; and increased life of the components.

● ● ●

THIS GIANT BARREL is responsible for reducing deburring time on precision jet engine components to one-fourth of former standards. Vane and shroud assemblies are fixtured stationary within the barrel, which rotates two-ton abrasive charge for deburring operation.



ROLL GRINDING IS RESPONSIBLE for most of the great changes in our lives during the past decade. It has made possible metal fabricating and finishes on sheet steel, alloys, aluminum, and other materials, which prior to that time represented careful hand-crafting at great expense. This 36" roll grinder will put a mirror finish on a roll weighing well over thirty tons. A safe operation running at relatively low speeds, success depends upon proper machine set up, work centering, and wheel balance.

GRINDING safely

By **Edmund Mottershead,** President
Mottershead Associates, Chicago

● Proper Wheel Balancing plays as important a part in grinding the largest and heaviest objects, as in roll grinding, as it does in grinding successfully with portable grinders. The same general precautions apply to all first quality grinding. Wheels must be balanced, mounted properly, dressed and trued, and run with suitable guards by trained operators.

In grinding rolls, balancing of the wheel takes on even added importance. Truing and dressing require careful attention, usually being performed with precision steel dressers for roughing wheels and with diamond tools for finish wheels and passes. The utmost care should be lavished on the journal rests, as the average roll is of great weight and is hard on its supports.

Experienced operators pay a good deal of attention to the size of grinding wheel in relation to the size of the roll being worked. Machines for cold rolled mill rolls generally mount wheels of 30" diameter, to be used for rolls of 20" diameter and under, but when the roll is larger and heavier, skilled operators want a wheel of 24" or less diameter in order to get a smaller arc of contact between the wheel and the roll in order to increase the unit pressure and get the abrasive teeth sunk well into the metal.

Wheels with a tendency to chatter can often be cured of this by reducing the width of wheel face, and some older operators simply forestall trouble by sticking to a narrow wheel face throughout, chamfering the corners of any wheel mounted on their machine.

Safe operation in roll grinding consists very largely of doing the job correctly. If the work is hung properly and the grinding machine is in good order, there should be no hazards except those created by the careless or show-off operator.

Manufacturers of roll grinding machines today incorporate into their machinery necessary guards of proper aperture for grinding wheels, and dust collecting and removing devices which may be required for dry grinding of non-metallic rolls such as may be made for paper mills. With work weighing into the tons, care in handling and moving the piece in the shop automatically starts a process of safe and correct job operations. • • •

GRINDING A STEEL CASTING with a cup wheel on an air-driven grinder. Operator's goggles must have full cups to provide adequate protection against flying dust and particles. Guard on wheel will hold wheel in place even in the event of wheel breakage.

How can you bear being up a tree?

If grinding wheel problems have you in a bearish mood—or even out on a limb—stop growling. Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money* . . . and *increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if you want the bare, down-to-earth facts on how to save money and increase production, contact your CINCINNATI Grinding Wheels distributor. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

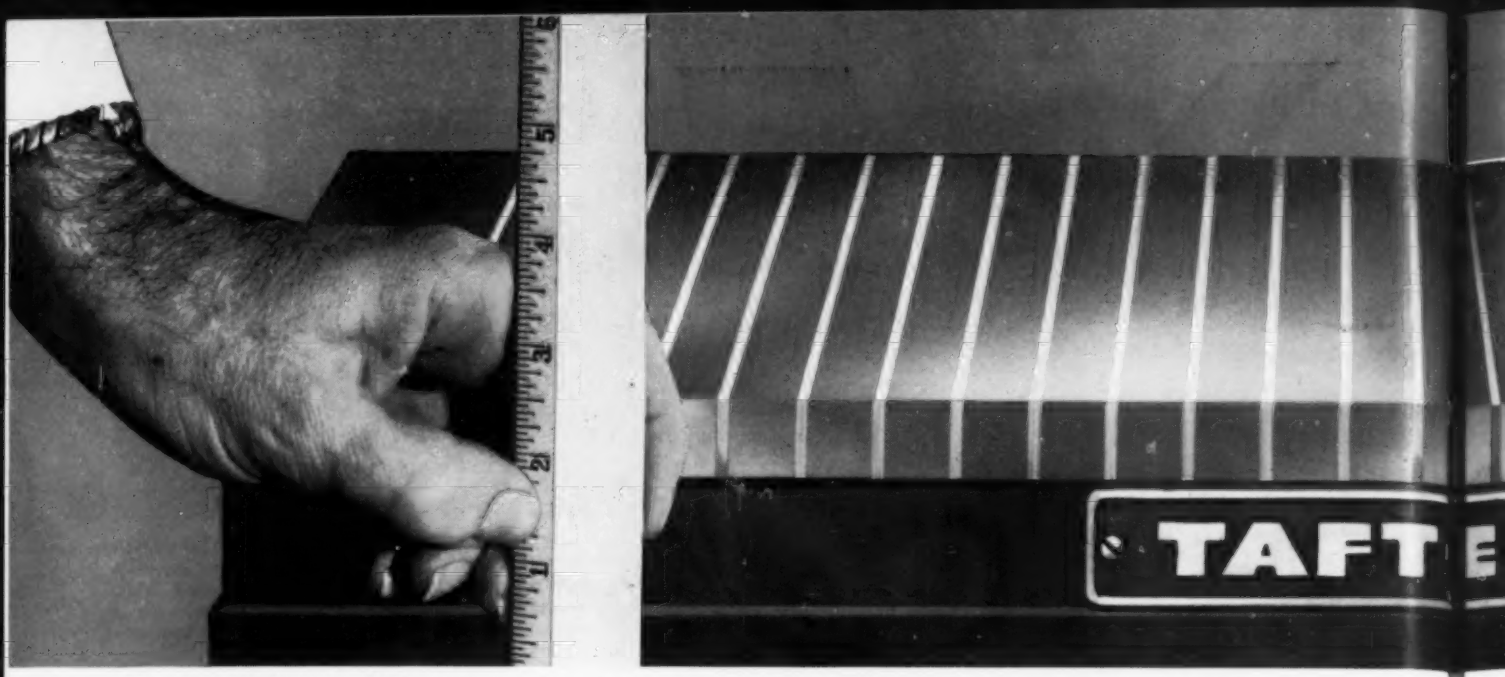
(PD) POSITIVE DUPLICATION

CINCINNATI® *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

Use postpaid card. Circle No. 217



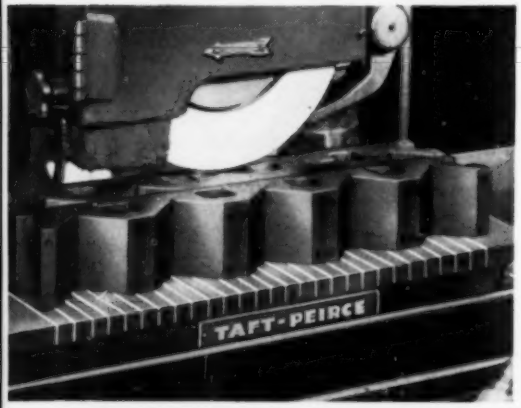
❶ LESS THAN 2½" HIGH. New low-boy design increases work capacity between wheel and faceplate by 1" to 1½" over conventional 8" x 24" chucks . . . a natural for handling the big jobs.

new

TAFT-PEIRCE 824*

PERMANENT MAGNET CHUCK

Low . . . Powerful . . . Precise . . . Easy to use



❷ 28% MORE HOLDING POWER . . . pecially engineered pack and concentration of flux gives extra holding power to handle practically all jobs, without complicated setups and with reduced costs.

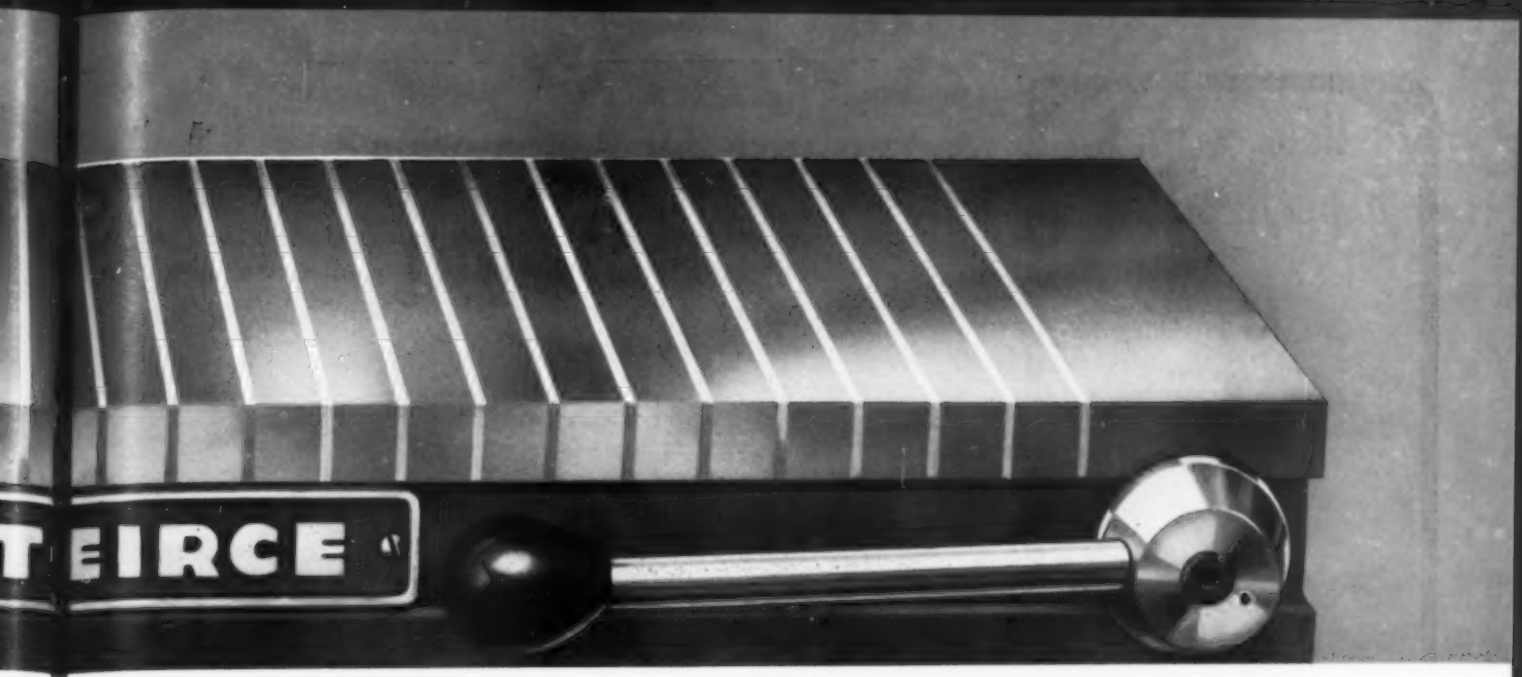
There's a lot of utility and cost saving packed into the new Taft-Peirce 824!

The 824 has been designed especially for *your* tooling and production requirements. Special Alnico V magnet design gives 100% all-over power, no dead spots — full edge-to-edge usable surface for ganging small parts or safely holding big ones. Holding power is better than ever — it's 28% stronger than comparable units.

Another big plus is the unique concept in faceplate design. New epoxy resin non-magnetic separators and special assembly techniques provide unusual stability and a much lighter chuck.

Check the many other shop tested features you see pictured on this page — a total of six exclusive advantages the new 824 brings to metalworking. The new 824 is ready now — through your nearest Taft-Peirce dealer or send your order to: The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

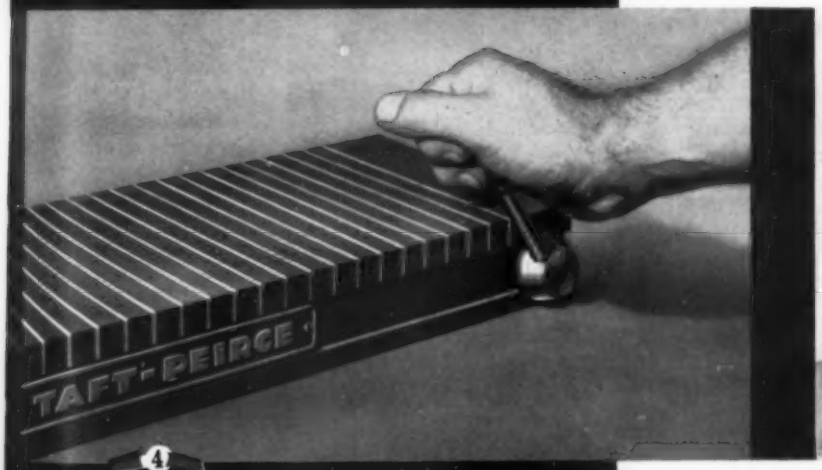
*PAT. APPLIED FOR

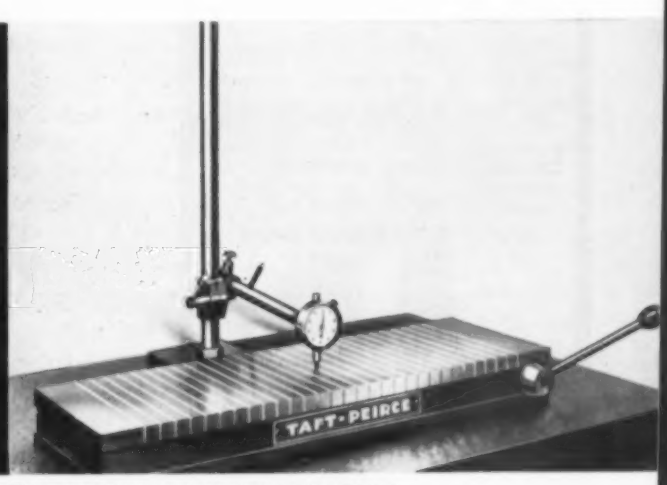


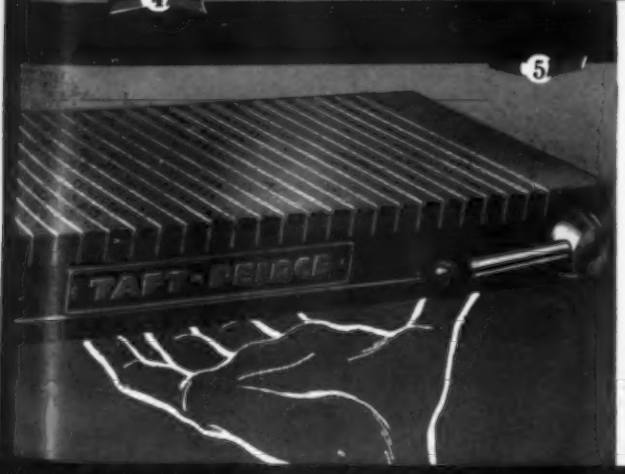
❸ CHUCK DRESSES WITHOUT WHEEL LOADING... new type separators keep the wheel clean. Grinding operations are streamlined, and unproductive time is cut to the minimum.

❹ NO MORE TROUBLE WITH RESIDUAL MAGNETISM... pack moves easily and quickly. With handle in "off" position, operator can get workpieces on and off the chuck in seconds.

❺ 27% LESS WEIGHT . . . than other chucks of the same size. Easy to handle — promotes greater utility, handy for ganging to handle big milling or grinding jobs.







❻ PRECISE, ACCURATE SURFACE... faceplate uses production-proved epoxy resin separators. Surface is more stable — perfect for close tolerance work.

TAKE IT TO TAFT-PEIRCE

T-P Means TOP Precision

How to find a perfect mate!

SPITFIRE

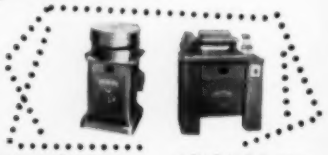
"Nth degree"
LAPPING MACHINES

Valve components, mechanical seals, many other parts require perfect mates . . . possible by producing surfaces of precision flatness and finish. This quality control is "built-in" around the world . . . with Spitfire Machines.

whatever your lapping requirements . . . SPITFIRE offers the proved answer:

Automatic Gyro-Matic "21"

Three basic elements: the human, mechanical and economical . . . are combined in the Gyro-Matic "21". Simple operation means any production worker can produce precision lapped parts. Micro-inch lapping to .0000116" flatness is standard. Rapid push-button control minimizes man-hours. Where critical parts are standard . . . so is the Spitfire Gyro-Matic "21".



Mechanical Lappers
Permits any size firm to incorporate super fine finishing on most production lines. The most economical method of attaining high level parts quality control.

Cylindrical Lappers
For closest tolerance finishes to 1 RMS or less on plug gages, shoulders, all types of cylindrical parts. Available in floor and bench type models.

Get full details . . . mail this coupon today!

SPITFIRE TOOL CO., Dept. GF-2
2931 N. Pulaski Rd., Chicago 41, Ill.

Name_____
Firm_____
Address_____
City_____ Zone____ State____

Use postpaid card. Circle No. 219

A Yardstick for Automation

How to measure automation? Here is a proposal, simpler than some being considered, that establishes orders of automation. Includes some crystal gazing at the possibilities when the higher orders of automation are a commonplace.

by **George H. Amber** and **Paul S. Amber**
Machine Control Consultants

A great deal has been said about automation the last few years. The public has certainly taken a fancy to automation, even though few agree on what **automation** means.

The interest most of us have in automation is in automatic production. However, engineers, designers, planners, and production are not the only ones who have talked about automation. It has also attracted the interest and opinions of labor leaders, politicians, and science fiction enthusiasts, and even a few sermons have been preached about automation. Each participant takes a subjective view of automation, so it is no wonder then, that automation has a different meaning to different people.

It is something like the story of the blind men who tried to describe an elephant. They considered it a wall, tree, brush, or snake, depending on what aspect they were examining.

But what does Automation mean? I don't know of a definition that will satisfy very many so I am not going to fall into the trap of trying to define it. You will be interested to know however, that the dictionary people have attempted a definition, and have included automation in the dictionary. Here is how automation is defined in the 1956 edition of Webster's New Collegiate Dictionary, by G. & C. Merriam Co.

Au'-to-ma'tion
(Automatic + ion)

1. The technique of making a process or system automatic.
2. Automatically controlled operation of an apparatus, process, or system, esp. by electronic devices.

As likely as not this definition will create more disputes than it settles. Most will go along with the first definition, but I am sure that many won't agree that electronics is necessarily the mainstay of automation, as implied by the dictionary's second definition.

I doubt that we will ever have a definition of automation that is acceptable to most interested parties. Fortunately, it doesn't really matter how **automation** is defined, or what it is, as long as we know how to use it.

Let us take the familiar word **electricity.** We know how to control electricity, how to measure it, and how to make use of it. But I doubt that many persons here would care to define electricity, or to explain what it is.

So it is with **automation.** By any other name, automation smells of hot metal chips, ozone, and coolants.

Rather than attempt a definition of automation, I suggest that we simply regard automation as the intensified use of automatic machinery to attain automatic manufacturing operations.

This concept is good enough for talking purposes, and for generalizing. It is not good enough, however, for our technical purposes, such as design and planning. **Electricity,** also an intangible, could not be handled until it could be measured. So it is with **automation.**

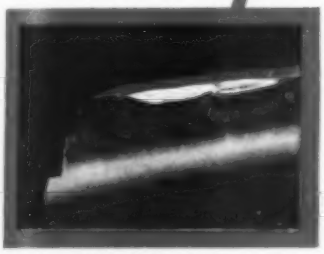
Universal opinion in scientific circles is that not much is really known about a subject until it can be measured. No one has explained this more clearly than did Lord Kelvin in 1883: "I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind." This statement, 70 years before automation, is entirely valid today.

The "Automation Yardstick" is our attempt to measure automation. We set it up mainly for our own uses. Here is how it came about.

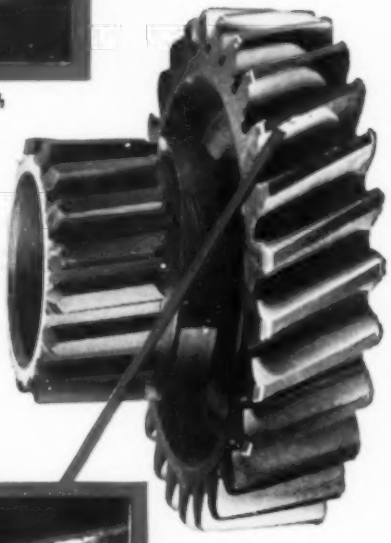
In addition to the conventional machine control circuits we design, we have also been advocating the use of small special purpose computers, which are intended for control system use as a part of the overall machine control system.

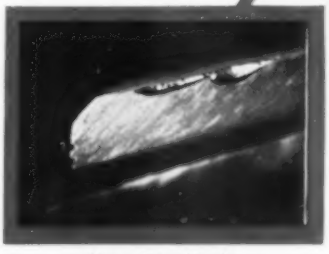
When we brought up the subject of machine control computers, some

RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS



Nicked Gear Tooth





Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

Use postpaid card. Circle No. 220

of our prospects and contacts would insist that computers have no place at all in automation. They held that automation was mostly materials handling, and depended mainly on conveyors, limit switches, and positioning devices.

Others claimed that without computers we do not have "true" automation at all. They said that Detroit brand automation consists of iron works and "meat hooks."

The question remained, "Do control computers belong in Automation, and if so, where do they fit in?"

Paul and I classified automation mainly so that we ourselves could see through the haze. We reasoned that once we could grade automation into specific degrees and orders, we could then determine where in the overall automation picture, machine control computers would fit in.

We were not the only ones to observe that the term automation was too abstract and indefinite, and that some method was needed to classify and evaluate automation.

Whereas Paul and I used a mathematical notation, to develop an "Automation Yardstick", Jim Bright used a graphic method to develop an "Automation Profile." His basis of classification was the type of control, and the power source (6). The same factors Amber & Amber identified as information and energy.

E. W. Leaver, and J. J. Brown, pioneer automation practitioners, wrote "A Functional Morphology of Mechanisms," which, appropriately enough, appeared in AUTOMATION magazine. They devised a classification scheme for devices, including automatic machines. Their basis of classification was also the energy, and information used by a device or a machine. (4)

All three techniques are amazingly similar, in many ways. All three techniques, though developed independently, came out within a few months of each other.

Here is how Paul and I set up the "Automation Yardstick."

As a start in developing a scale for "measuring automation," let's find the "least common denominator," the basic indispensable factors of any job. In our opinion, there are only two such basic factors. No job, whether manual or highly automatic, can be accomplished without both factors. These two basic factors are **energy** and **information. Energy** does the job. How the job is done is controlled by **information.**

The **energy** to do a job can be provided by either a man or a machine. In either case, this is only one grade of energy, and it is either available, or it is not available.

Information, what job is to be done, and how to do it, can also be provided by either a man or a machine. But there are many grades of information, as will be shown, that can be used to control the energy used to accomplish a job. Classifying automation consists mainly of classifying the information that a machine uses.

A "beast-of-burden" can be used to provide energy, and even to provide some information. The milk-wagon horse (nearly extinct) who knows the many stops of his route is known to all of us. And how does a trained horse fit into the automation picture? Only to illustrate that there have been means of replacing man's energy, and even some of the necessary information in doing a job, for thousands of years.

Hand tools are definitely mechanical aids to man's working ability. However, hand tools do not provide any energy, and little, if any, information. They do greatly increase man's abilities to perform tasks, by making many jobs possible, such as sawing wood, that cannot be done at all without tools. But hand tools have no self-acting qualities, thus they have no automaticity. Other mechanical devices, such as block and tackle, bicycle, jack, slingshot, and vise, are more than mere hand tools. These mechanized contrivances, in a broad general sense, are "hand powered" machines. Here, too, however, the devices add no energy. They merely transform man's energy to a more efficient form.

In either case, hand tools, such as knives and screw drivers, and non-

POPE engineers and builds
20,000
Different motorized and Belt Driven
SPINDLES
one of which may be just the one to
LOWER YOUR PRODUCTION COST

Here are only a few representative Pope Precision Spindles:

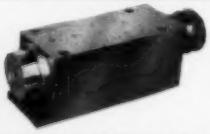
FOR SURFACE GRINDING
POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

FOR HEAVY DUTY MILLING AND GRINDING

POPE ¼ to 100 HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

FOR TOOL AND CUTTER GRINDING

POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH
POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepowers and speeds.

FOR INTERNAL GRINDING
POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

FOR HIGH CYCLE GRINDING AND MILLING

POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM. They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

Send us your specifications and get prompt quotations on the one best Spindle for you out of the 20,000 different Precision Spindles that bear the name "POPE."

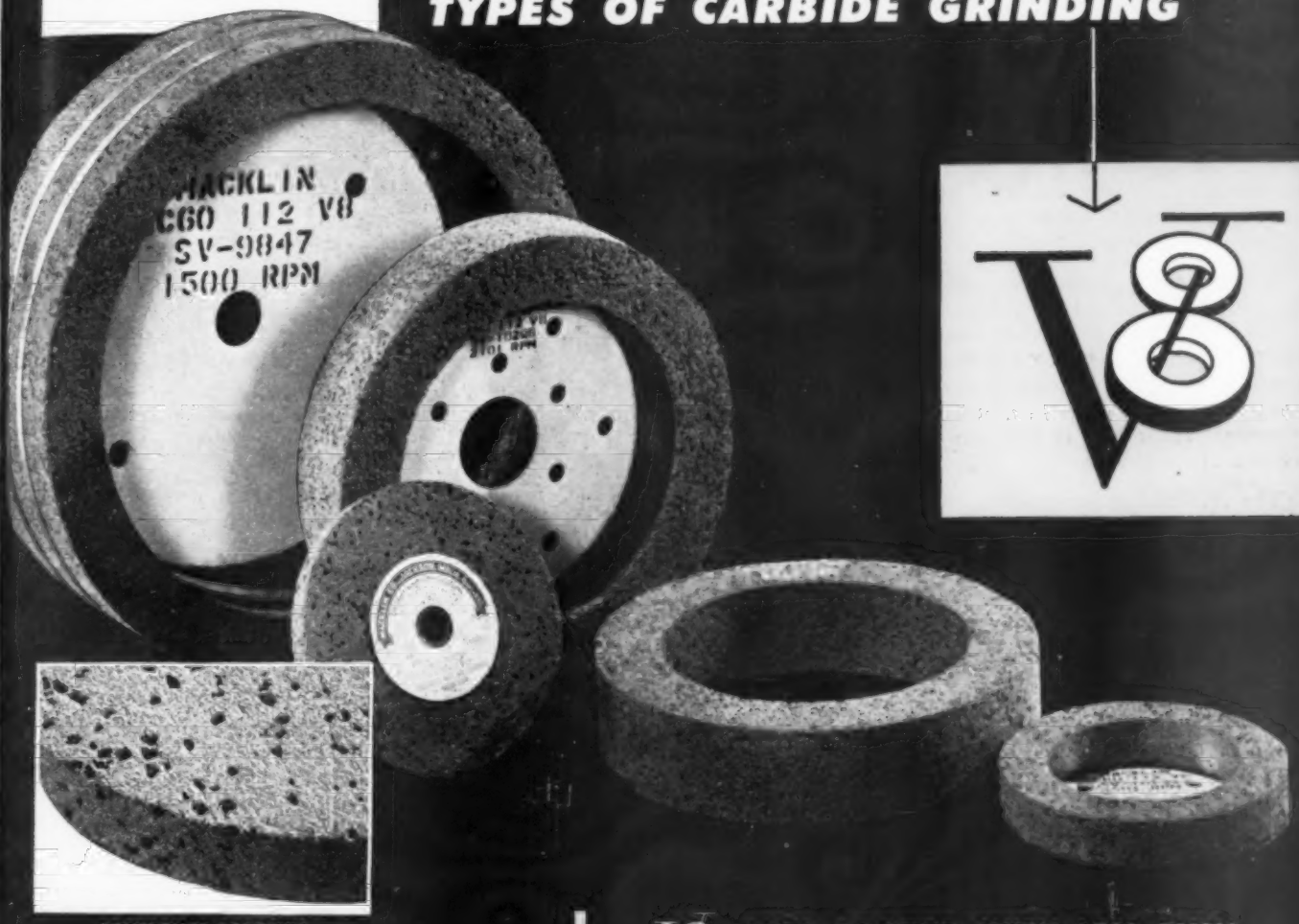
No. 116

Specify POPE PRECISION SPINDLES
POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

Use postpaid card. Circle No. 221

NEW MACKLIN

INCREASES PRODUCTION ON ALL TYPES OF CARBIDE GRINDING



CONTROLLED POROSITY
Note the open pore structure on this close up of a Macklin V-8 Wheel.

The new Macklin V-8 Wheel sets new standards of grinding performance. OPERATORS LIKE IT because of its soft, smooth "feel". It's easy on the wrists, easy on the tools, *cuts faster with less push.*

MANAGEMENT LIKES the long wheel life of the V-8 wheel, the way it increases production and cuts operator fatigue.

- V8 ***CUTS FASTER WITH LESS PUSH***
- V8 ***EASIER ON TOOLS***
- V8 ***EASIER ON OPERATOR***
- V8 ***HAS A SOFT, SMOOTH "FEEL"***

TEST V8 ON YOUR OWN JOB

It's a fact. Test the new V-8 Wheel on any one of your carbide grinding jobs and you'll switch! You get faster, cooler cutting . . . longer wheel life. But don't take our word for it. Test the V-8 Wheel *in your own plant . . . on your own job*

FOR A DEMONSTRATION WITHOUT OBLIGATION, CONTACT YOUR NEAREST MACKLIN DISTRIBUTOR OR CALL FOR THE SERVICES OF A MACKLIN FIELD ENGINEER.

V8 THE NEWEST IN MACKLIN'S *"WHEELS OF PROFIT"* FOR INDUSTRY

MACKLIN company DEPT. 32 JACKSON, MICHIGAN

continued

powered "machines," such as egg beaters and foot powered sewing machines, insofar as they do not work by themselves, and contribute no energy to a job, are considered zero automatic.

It will now be shown that each of man's faculties that can be performed by a machine raises the order of automaticity of that machine. Automation is here interpreted as being the summation of the individual automaticities of each station or machine in a manufacturing process.

We are all familiar with the character "F", used instead of Fahrenheit, when referring to a specific value of the temperature scale. The automation yardstick developed here makes use of a similar symbolic representation. The character "A" is used to represent the **automaticity** scale.

The class of hand-powered mechanisms, including hand tools, that provide none of the energy, and only a negligible amount of the information required to do a job, can be shown symbolically as A_0. A_0 represents the **zero order** of automaticity.

The simplest devices that replace any of man's efforts are the power tools. These provide most of the energy requirement. A man's duties when using a power tool are mainly controlling it and feeding work to it. Feeding work to the power tool, or the power tool to the work, still requires appreciable energy in many cases, such as when power saws are used.

However, the fact that one of man's faculties, providing energy to do the basic job, has been alloted to a machine, does not give the machine a quality of automaticity. The familiar "holegun" handdrill, powersaw, jack hammer, cutting torch, and even the punch press, are in the class of tools having the **first order** of automaticity. This is so because they replace a human faculty, the energy to do the basic job. This is A_1, the first order of automaticity.

The class of power tools that also possess power feed, such as radial drills, cutoff saws, and bench lathes, possess the **second order** of automaticity, A_2. These machines provide **all** of the necessary energy for a given operation. Control is still the job of the operator. But once the work is in place, and tooling is set up, all he needs to do is to start or stop the machine, or change controls.

Once we have power drive and power feed, the next logical step is to have the machine control itself. Machines that control their operations have the third order of automaticity, A_3.

At last man can stand back and see a machine do an entire job, without his intervention. The **information** or how to do the job, including the concept of skill, is built or set into the machine function, the tooling, and the control system. Examples of A_3 machines are automatic nail machines, automatic die-casting machines and automatic-cycle machine tools. The clue is in the word **automatic.** All **automatics** are A_3 at night.

What is Control?

Let us see what is meant by control of a machine. **Control** in its simple form consists of turning on or actuating a station; or as in the case of the turret lathe, transferring from one operation to the following one on the same machine. Obviously, a control function built into an A_3 machine, such as a modern automatic-cycle machine tool, can also be used to actuate the control system on a succeeding machine. Whenever we do have a series of A_3 machines with integrated sequential control systems, we have **automation.**

"Detroit" automation is largely of

HANCHETT

METAL SAW SHARPENER

for HOT or COLD CIRCULAR SAWS
Solid or Inserted Tooth Types

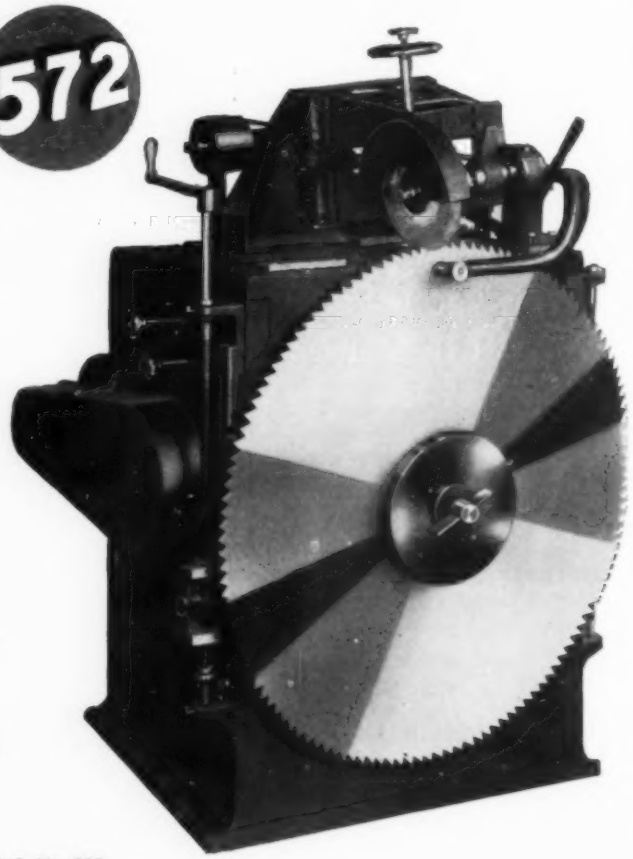
HEAVY DUTY – BALANCED DESIGN

Straight Line Grinding Wheel Feed Action – Smooth and Accurate

Wheel Head Adjustable for any Saw Tooth Angle Desired (Cam Action)

- Grinding wheel speed is adjustable for wheel wear
- 100% anti friction bearings for smooth, trouble-free operation
- Accurate—simple stroke adjustment for both feed and lift cams
- Rugged construction for hard, heavy duty performance
- Heaviest stock removal at high production rate
- Grinding wheel head motor—two h.p. (belted type)
- Capacity—24" to 72" diameter saws (larger when required)
- Available—other sizes and types of machines to meet all saw requirements

MODEL 572



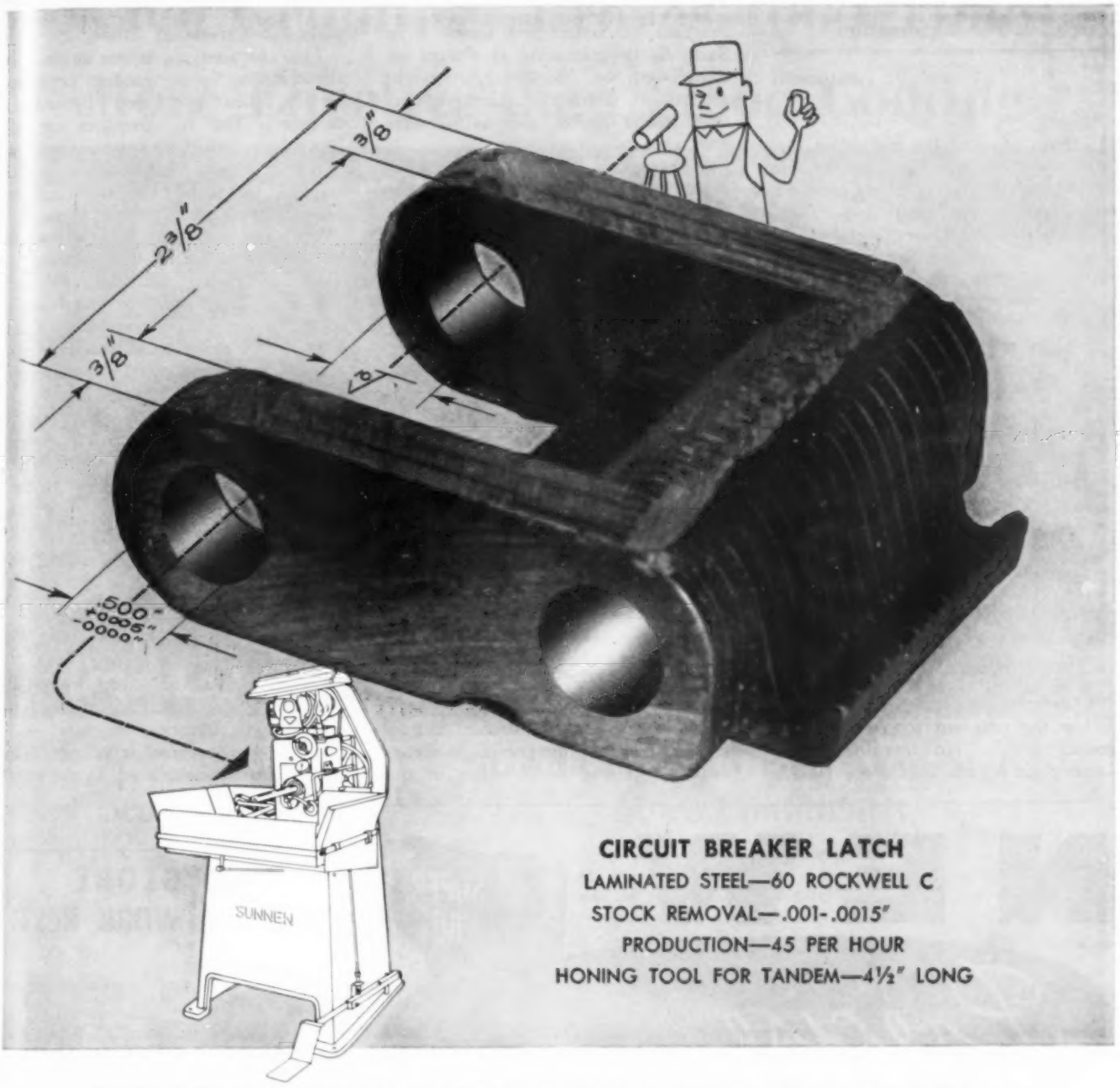
HANCHETT MANUFACTURING COMPANY

World's Largest Manufacturers of Saw Sharpening and Knife Grinding Machinery

MAIN OFFICE: BIG RAPIDS, MICHIGAN

WEST COAST: PORTLAND 1, OREGON

Use postpaid card. Circle No. 223



CIRCUIT BREAKER LATCH
LAMINATED STEEL—60 ROCKWELL C
STOCK REMOVAL—.001-.0015"
PRODUCTION—45 PER HOUR
HONING TOOL FOR TANDEM—4½" LONG

HOW TO ASSURE ALIGNMENT OF TANDEM BORES

Tandem bores are often a problem: Boring or grinding from one side requires a long quill or bar which tends to spring, jump and chatter. If you bore or grind from both sides, turntable error, wear or unequal stock removal can upset alignment. Reaming, too, can give you problems with tolerances, finish and alignment.

Your answer is Sunnen Honing! It assures perfect alignment, size and finish every time . . . for tandem and multiple-land bores. Reason: The spaced lands are all honed simultaneously . . . by a honing tool of sufficient length. The holes are *self-aligning* on the long honing tool.

No fixtures or turntable . . . no clamping distortion or tool deflection . . . no side pressure or tool chatter.

GET ALL THE FACTS ON SUNNEN HONING

SUNNEN®
PRODUCTS COMPANY
HONING

7921-B Manchester Ave. • St. Louis 17, Mo.

SEND FOR FIVE
INFORMATIVE BOOKLETS

7166

Use postpaid card. Circle No. 224

Yardstick for Automation

continued

this type. Most of the individual machine tools are A_3. The machines are coupled together by conveyors, indexers, manipulators, and positioners. These "transportation machines," between the machine tools proper, are also A_3. The proof that they are A_3 is that they are completely automatic, providing all necessary **energy,** and too, by means of built-in routing and guides, the necessary pre-programmed information.

Another form of A_3 machine is the special-purpose, automatic, continuous manufacturing machine, such as those of Detroit's Hautau Engineering Co. This type of automation machine has for the most part machine-tool station and transportation elements all designed to operate as a single integrated machine.

The "information" built into a machine is really a form of **programming.** An automatic screw machine obeys the program, determined by the sequencing and set up of the tools on the turrets. An automatic milling machine may follow the program represented by a master profile. No machine classed lower than A_3 can follow any built-in program, no matter how simple it is. Such A_3 programming is always accomplished by "hardware," straight mechanical, electromechanical, or electrohydraulic devices, such as followers and piece part duplicators.

Whenever the machining program is in the form of paper tapes, magnetic drums, punched cards, or other programs that are not physically set into the machines, automaticity greater than A_3 is usually required. This is so for two reasons. One is that some computations may be necessary to de-code nonhardware programs, as from paper tapes. The other reason is that machines using "paper" programs are usually of the closed-loop, self-correcting feedback type.

For all practical purposes, today's automation is almost entirely A_3. Functionally, the various machines are usually arranged output of one machine, to the input of the succeeding one. On layout paper, such automation resembles the "tails and trunk" arrangement of circus elephants on parade.

We know that complex A_3 automation systems "obey" the program designed into them faithfully. Too much so at times. The principal drawback of A_3 is this "blind obedience" characteristic. The machine goes right ahead, even if the tool is defective, or the parts fall outside of limits.

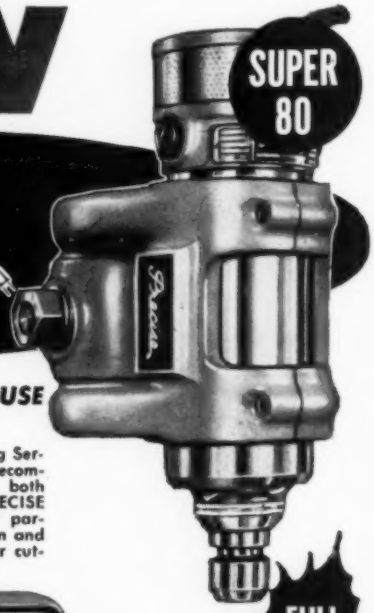
This characteristic of not automatically checking up on machine performance is called "open loop" by control designers. The A_3 machines are all "open loop," excellent for most routine heavy manufacture—not quite precise enough, or sufficiently flexible, for some high-accuracy requirements.

Machines that check on their work can be said to have some "judgment." These completely automatic "closed-loop" machines possess the **fourth order** of automaticity, A_4. They monitor their own output, automatically making corrections to their settings as necessary. Or, as in the case of some automatic honing machines, they continue with their function until the part is to proper size. A_4 machines of the self-correcting type, are most frequently encountered in continuous processes. To be properly A_4, the feedback (self-correcting signal) must refer the basic work being performed, to a standard. Any necessary linear corrections can be made by means of power servo actuators. Incremental corrections, more frequently attempted in machine tools thus far, are accomplished by "stepping." An incidental non-basic self-regulating feature of a machine, such as speed, temperature, or voltage, does not necessarily make it A_4, as the work

NEW

Precise POWER QUILL

SUPER 80



HIGH-CYCLE PERFORMANCE WITHOUT USE OF COSTLY HIGH-CYCLE EQUIPMENT

Continuously Variable Speed Range Through Electric Control with Simple Dial Calibration — 7000 to 25,000 RPM.

Largest and Most Powerful Available.

Super Accurate Collet Chuck with ½" Capacity to Insure Maximum Rigidity for modern precision demands. (Available also with solid quill extension for mounting wheels to ½" I.D. and 2½" O.D.)

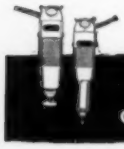
Unlimited adaptability to single or multiple grinding-milling operations . . . Tolerances of .0001".

Operates from standard 115V power supply.

Our Complete Engineering Service is available for recommendations and advice both on the application of PRECISE POWER QUILLS to your particular production problem and for the use of the proper cutting tool on your job.

Control cabinet permits speed regulation with motor calibrated in RPM.

FULL 1½ H.P. AT THE QUILL



Precise

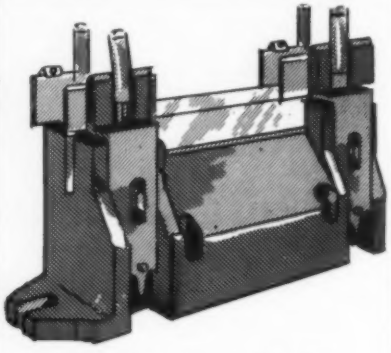
PRECISE PRODUCTS CORP.

3735 BLUE RIVER ROAD, RACINE, WISCONSIN

QUALITY AND PRECISION SINCE 1882

Use postpaid card. Circle No. 225

NEW GLOBE THRUFEED WORK REST



DELIVERY from STOCK! FOR NO. 2 CINCINNATI CENTERLESS GRINDER

6" THRUFEED (Without work blades) $260.00

8" THRUFEED (Without work blades) $265.00

(above F.O.B. Detroit)

Dealer Inquiries Invited

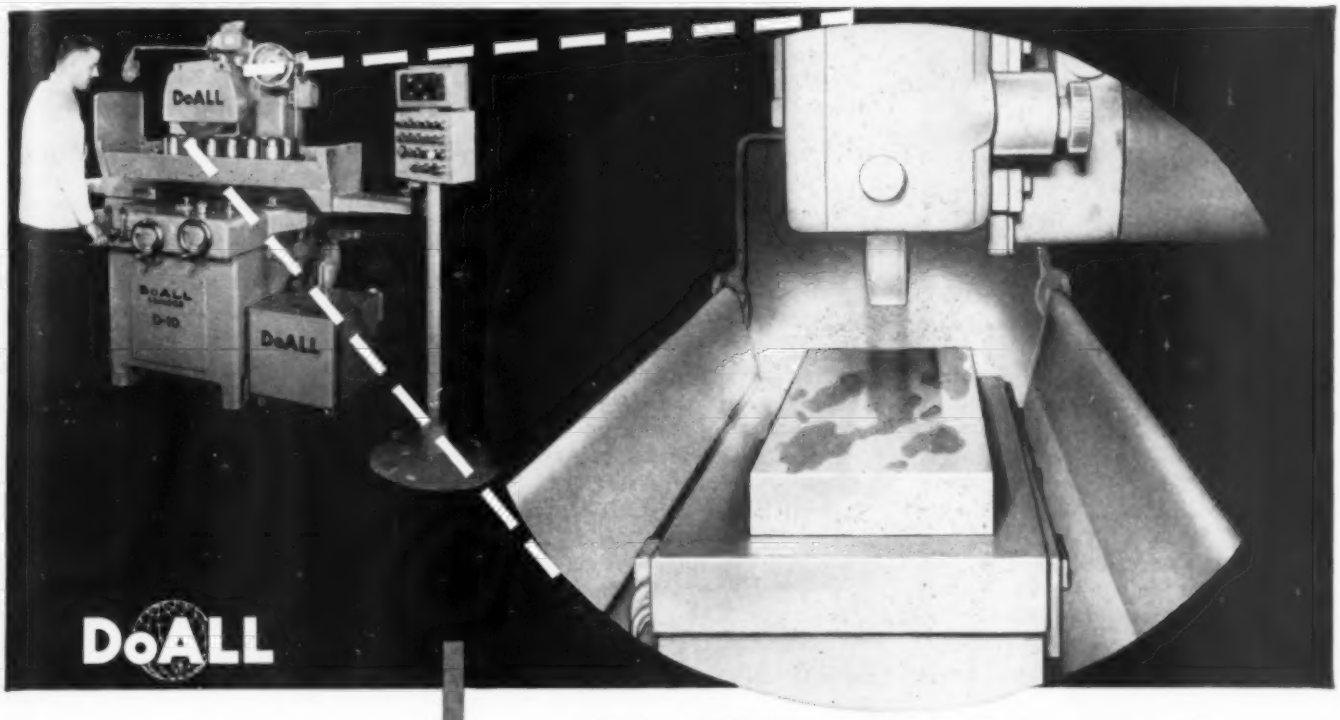
GLOBE TRADING COMPANY

1815 Franklin St., Detroit 7, Mich.

Phone WOodward 1-8277

Use postpaid card. Circle No. 226

"Cool Grinding" Proves 1000 Times More Effective than Flood Cooling



Mist Provides 1000 Times More Heat Absorbing Surface

A cubic inch of coolant offers six square inches of heat absorbing surface.

Atomized, each of the 1,000,000,000 cubes offers .000006 square inches of surface or total of 6,000 square inches over all.

In "COOL GRINDING" coolant is fed to the sides of the wheel. Centrifugal pump action draws the coolant into and through the wheel. It emerges atomized, right at cutting edge.

Grind Faster, Grind Accurately, More Confidently

Atomized coolant, as shown at left, is 1000 times more effective as a heat absorbent than liquid coolant. "Cool Grinding" puts this atomized coolant directly at the point of work-wheel contact. Temperatures are reduced as much as 1300°F as compared to flood cooling.

Aids Precision in Grinding—Efficient heat dissipation prevents expansion—helps assure close control of dimension and parallelism.

Ground Parts Last Longer—"Cool Grinding" eliminates burning, checking and stresses—a source of premature failure of ground parts resulting from high heats and quick quenching.

Increased Production—Grinding can be done at faster rates, without heat expansion or damage.

Dry Grinding Visibility—Mist does not obscure work, visibility is unlimited.

Wheel Life Increased—Continuous flushing and cooling action *in* the wheel greatly increases its life.

Standard Grinding Wheels—No need for wheels with "special" arbor holes.

Coolant Recirculates—Saves on coolant. Special filter cleans the coolant before reuse.

Free In-Your-Plant Demonstration—DoALL will bring a grinder to your plant and show you how to increase your grinding profits. Write: **The DoALL Company, Des Plaines, Illinois**

FREE MOVIES—Sound and color to show you the ultimate in precision grinding. Call DoALL locally or write.

FREE CATALOG—Shows design and construction of DoALL Grinders and accessories including "Cool Grinding".

Friendly DoALL Sales-Service Stores In 38 Cities.

Cool Grinding U.S. Pat. No. 2470350

MACHINE TOOLS ..... CUTTING TOOLS ..... GAGES ..... GRANITE PLATES ..... TOOL STEEL

GR-17

Use postpaid card. Circle No. 227

continued

proper is not directly affected.

Probability Effects

We know that the dimensions of parts produced on a machine usually exhibit a "natural tolerance" caused by the organic "non-assignable" variation of the machine. Therefore, the dimensions of individual parts are usually of a random nature within the machine's dispersion zone, following the normal probability curve. The size of any individual part may fall anywhere from the high to the low tolerance limit and still be acceptable. Having a sensitive, closed-loop, self correcting A_4 machine respond to individual measurements will only cause it to chase from one dimension to another. The outcome is that the machine's dispersion pattern is amplified! The closed loop self-correcting A_4 machine could produce more rejects than conventional A_3 machine, without feedback, if the A_4 control system is not adequate.

One practical solution towards having self-correcting features, without being "distracted" by the normal **range** of measurements, is accomplished when the machine "remembers" a part dimension, and does not initiate corrective action until 2 or more parts indicate a definite trend or drift that must be corrected. This is known as post-process zone control.

Another solution is to compute the **machine-mean,** the centerline of machine performance, for use as a self-correction index, instead of using an individual piece-parts measurement. This can be accomplished by means of small built-in special purpose analog computers. The computer calculates the machine-mean by averaging individual measurements. An advantage of a computed machine-mean is that the same computation is usable for an automatic quality control computer.

Our design firm, Amber Brothers, Inc. has worked out methods for using small special-purpose computers, to control the operation of industrial machines. A recent article we wrote, showed how to use such control computers to solve for the mean X, and the standard deviation, σ (sigma) within the control system of a machine. This article was "QC Computers for Machine Control," which appeared in ELECTRICAL MANUFACTURING.

If you would like to know more about our computer control **techniques,** and how they apply to automation, send for a copy as follows. Ask for reprint 225, from:

GAGE PUBLISHING CO.
1250 Sixth Avenue
New York 20, N.Y.

There is no charge for single copies.

Fifth Order of Automation

A computer in a machine's functional control system, or program control system, indicates that the machine possesses the fifth order of automaticity, A_5. Machines of the fifth order of automaticity do not depend on a direct control or feedback signal. Instead, these A_5 machines respond to a mathematical function of either the control or feedback signal.

A_5 machines can compute the **machine-mean** to be used as a reference for self-correcting machines, or to be used for further automatic quality control computations.

The possibilities for A_5 machines, based on computer control, are endless. Other examples of A_5 machines with built-in computers are a machine that would automatically "optimize" by solving maximum vs. minimum re-

NEW 25° Tilting Spindle makes set-ups easier on the STERLING "G-2" Tool & Cutter Grinder

Direct, positive clearance angle setting without formulas is easy with this NEW Sterling 25° Tilting Spindle. Any angle setting remains the same for every diameter cutter from the smallest to the largest. Set-up time is reduced, hard-to-handle jobs are made easy and accurate grinding is assured.

EXTRA CAPACITY—

Large top table with 18" travel, 8¼" cross movement, 10¾" swing, full flexibility of table and spindle provide the extra capacity so often needed. Write for complete information and low prices on plain and universal STERLING "G-2" Tool and Cutter Grinders.

McDONOUGH MANUFACTURING COMPANY
1522 GALLOWAY, EAU CLAIRE, WISCONSIN

Use postpaid card. Circle No. 228

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request
A few desirable distributor territories still available.

WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

Use postpaid card. Circle No. 229

Metal removal *faster* at lower cost

CHICAGO MOUNTED WHEELS

Prompt Out-of-Stock Deliveries

There is a precision-engineered Chicago Mounted Wheel or point for every imaginable grinding operation. Ideal for efficient, effective deburring. . . . Always available . . . in all standard sizes, and over 200 special shapes, for out-of-stock delivery. Save Time – Money – Materials . . . Specify Chicago Mounted Wheels!

Every Chicago Mounted Wheel is produced under positive production control . . . assuring perfect uniformity of mounted wheels and points. There is no variation from one production run to another.

Positive density control for peak job performance

Guaranteed to stay on the mandrel . . . perfectly balanced

Chicago Mounted Wheels are easily dressed and hold their shape

Unlimited number of combinations of dimension, shape, grain, size and bond

WRITE FOR *Trial* CHICAGO WHEELS

Test them yourself!

Send coupon for two Chicago Mounted Wheels . . . Test one against the other . . . you'll see the meaning of true uniform performance!

CHICAGO WHEEL & MFG. CO. G
1101 W. Monroe Street • Chicago, Illinois

Send me two sample Chicago Mounted Wheels without charge:

Name .....

Address .....

City ..... Zone ..... State .....

Use postpaid card. Circle No. 230

Do You Have A Deburring Headache?

GET THE FACTS ABOUT

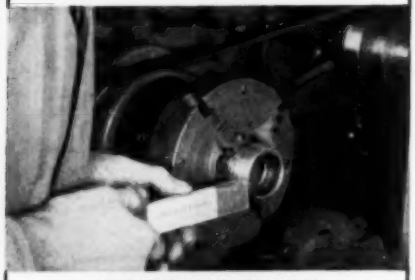
CRATEX
RUBBERIZED ABRASIVES

"The World's Best For Industrial Use"

Exceptionally superior and unparalleled for:

DEBURRING, SMOOTHING, CLEANING and POLISHING operations after dimensional shaping

For removing rust, heat-marks, tarnish, fatigue lines, scratches, excess solder, corrosion and other surface defects: for blending-in polishing welded seams, final sharpening and polishing to lustre-like finish.



CRATEX IS MADE IN FOUR DIFFERENT GRITS

Coarse Grit to Extra Fine in

WHEELS · POINTS · BLOCKS STICKS · CONES

For Machine or Manual Application on the broadest range of Hard and Soft METALS and other Materials

Backed by over 30 years industrial, professional and technical application, CRATEX Rubberized Abrasives are widely used nationally and in foreign countries. Made from "premium quality chemical rubber bonds" pressure-molded into uniform textures without hard or soft spots—resilient to absorb shock—ready for instant use—offer uniform controlled "cushioned action" with ease of manipulation for dimensional accuracy, without loss of tolerances.

OPERATE SAFELY, EFFECTIVELY AT SPEEDS UP TO 5,500 S.F.P.M.

Send for comprehensive illustrated catalog—learn how CRATEX Rubberized Abrasives can cut your costs, speed production and insure quality results. Sold at leading industrial supply dealers.

CRATEX MANUFACTURING CO.
81 Natoma St., San Francisco 5, Calif.

Use postpaid card. Circle No. 231

Yardstick for Automation

continued

lationships. In plain words, machines with small built-in special purpose computers can do some of the routine "design" of the product they produce. An example would be a punch press that automatically positions the stock so that the maximum number of piece-parts could be stamped out of the minimum amount of stock. Or, a machine that designs, and fabricates a wide range of shock absorbers, in accordance to dial settings of damping rate, travel, and frequency.

A machine tool with a built-in automatic machinability-computer would be another example. Such a machine tool would remove metal at the fastest permissible rate, taking into account the tool, surface speed, material, and other machinability variables even if they are continually changing.

The next big step in automatic machinery, and automation, involves A_3 machines. True, they may be years away, but only because of the normal inertia of industry, and the big investment in machine tools. But the trend is toward A_5. What is more, the techniques and "hardware" for making up the many small analog computers so necessary to A_5 machines, are already at hand. So a peek at two admittedly futuristic A_5 machines will be of interest.

It is entirely feasible to design a steel mill to roll beams having the optimum cross section. This rolling mill would automatically adjust the spacing between the rolls according to the output of a computer. The computer would accept span and load factor settings and work these into beam dimensions by solving conventional beam formulas. The result would be beams with the optimum cross section and moment through each point of length for the design shear and bending loads or allowable deflections.

In this way, using computers to control the mill, custom beams could be produced as readily as standard I-beams are rolled at present, and at considerable savings in dead weight and cost.

A good part of automation today consists of moving parts around so that the proper part is at the correct station at the right time. This is accomplished in most part by conventional methods using shuttles and conveyors. Once these conventional transfer devices are designed and installed, the system becomes inflexible. Any significant change in product or process requires radical redesign of the conveyor equipment.

This can be avoided by the use of elementary military fire-control practices to sort and position parts by selective, controlled, catapulting. Yes, throwing the parts into position is a bold move.

A machine of this type would defy obsolescence as it could readily be adjusted by merely resetting dials when so required by product changes. In this way it could accommodate and position a wide variety of stock to an unlimited number of stations.

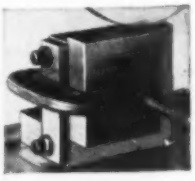
By means of an aerial transfer machine, parts in process would be "lofted" for three-dimensional positioning. A somewhat simpler version would be to "kick" the parts across a free surface table for two-dimensional positioning and timing.

This technique represents precision control based on the simple basic concepts of military ballistics and bombing practice. The shocks can be kept as low as necessary on both the catapult and receiving ends. In addition, the receiver need not be stationary, but can be a moving station on a turntable. A setup of this kind requires computers to solve the simple ballistics equations to determine proper catapult exit velocity, elevation angle, time of flight, and "target" lead angle. The mass of each

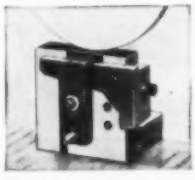
LASSY **MASTER V-BLOCK**

ANGLE PLATES

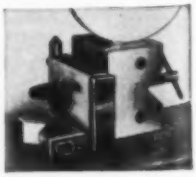
This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.



Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



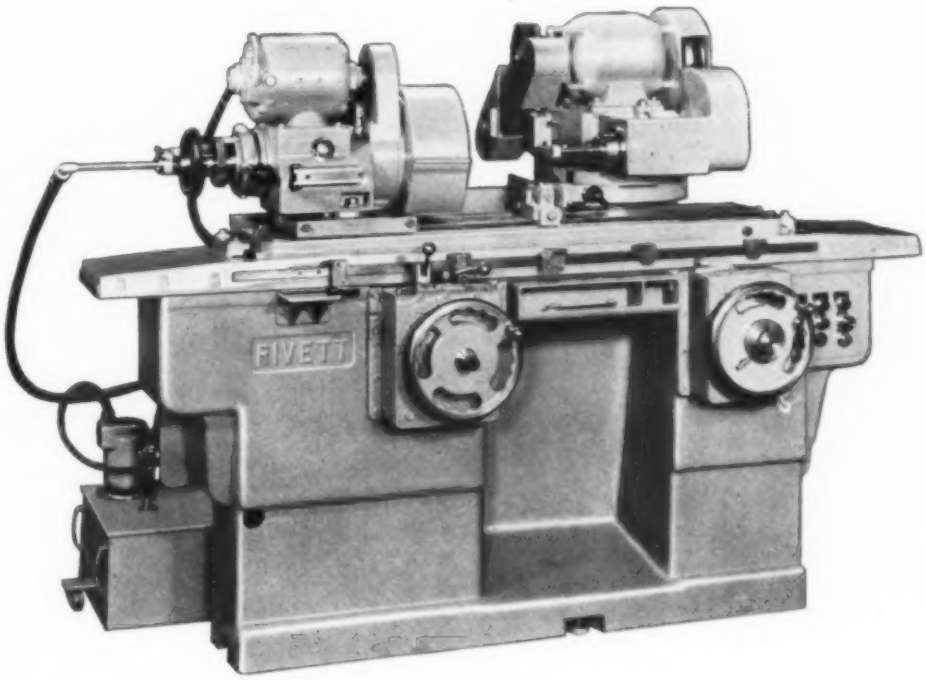
LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

WRITE FOR DESCRIPTIVE LITERATURE

LASSY TOOL COMPANY

PLAINVILLE, CONNECTICUT, U.S.A.

Use postpaid card. Circle No. 232



GRINDS INTERNALLY AND EXTERNALLY EQUALLY WELL?

SURE! THAT'S WHY OUR RIVETT IS THE MONEY-MAKING-EST GRINDER IN THE SHOP!

Rivett 1024 Internal and Universal Grinder

You can keep this grinder always busy! Do any number of internal jobs and then switch over to external work. It has all the features of a true internal grinder — extra-long table moves sufficiently to left to permit plug gauging to 6″ depth without retracting wheelhead slide. External wheelhead is not hinged, but swivels a full 180° for quick conversion! Grinds any hole to 9″ diameter and externally to 12″ diameter.

No need for two special machines when you have a 1024! — particularly where grinding jobs are varied and production on any one run is limited!

RIVETT LATHE & GRINDER, INC.
Department GF-2 Brighton 35, Boston, Mass.

Get *all* the facts in Bulletin 1024B. Write for your copy today!

RIVETT
INTERNAL & UNIVERSAL GRINDERS

Use postpaid card. Circle No. 233

continued

item can be preset on dials or obtained by automatic weighing.

How to Solve Computer Control Equations

Most mathematical solutions for machine control purposes can be accomplished by items on the electrical designer's shelf, such as potentiometers, amplifiers, resolvers, and motors. Needless to say, the mechanical side of such a machine is a challenge to machine designers.

Practically speaking, A_5 machines, those whose functions are controlled predominantly by means of computers, are all we can expect to see in industry, in our day. Higher orders of automaticity will appear earlier in non-industrial machines. For the most part, these are at this time "paper-talk" systems, not immediately practical.

Further information on how to use machine control computers for automation, is in our book "Control Computers," which will be released by Ronald Press Co. later this year.

We have now separated automaticity into discrete steps. Each increasing order of automaticity indicates that an additional level of human activity has been replaced by the machine. The graduations, the **orders** of automaticity, form the basis for the automation yardstick.

All three methods of classifying and evaluating automation; by Jim Bright, Leaver & Brown, and Amber & Amber, are remarkably similar, as all three use energy and information as the basic denominator. All three methods help understand automation, and are valuable in making more effective use of automation techniques. All three methods suffer the same deficiencies.

A big problem is, just how fine a scale should be used in classifying automation? If the graduations are too close together, with sub classes, the system becomes unmanageable. If the graduations between the various levels of automaticity are too broad, we can't give a good evaluation of automation.

Jim Bright was well aware of this. He said, "The problem is that machines do a lot more than we think and the thing which I ran against and which you will too is: What do you do about the machine that has some 80 functions some of which are on my Level 3 or 4 and others are scattered up through the entire set of levels to Level 14 or even 16? You would have to add some kind of notation to clarify this."

He also commented, "My charting idea forced me into a realization that a given machine was not necessarily on a given level of automaticity. Even the individual machine embraces four or five degrees of automaticity. This is further confused because some of the functions are very important ones in that they are the prime functions of the machine and others are rather secondary. Should all of them have equal weight? My practical approach to this was to chart what I intuitively felt was the main essential nature of the machine and in a few cases, to indicate by dotted lines or an auxiliary notation the level of automaticity of some significant function of the machine. This is not very scientific but it's the best I could do at the moment."

So in conclusion, we see that there are existing techniques for classifying and evaluating automation. There is room for improvement in all of the three published methods. Developing a standard method for classifying and evaluating automation could be a worth while task for an industry wide SAE or ASME committee.

As for now, I dedicate the "Automation Yardstick" to the production men in Industry who don't just talk about automation, but make it work. • • •

MISTKOP
STOPS MIST
COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE
NON-ELECTRONIC!
This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*
Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.
AGET Manufacturing Company
1380 Church Street • Adrian, Michigan

Use postpaid card. Circle No. 234

When you see THIS . .
. . it's a job for THIS!
WHEREVER drawings specify microinch roughness, the Profilometer® is the practical means for checking the parts against those specifications. *Here's why:*
1 The Profilometer *measures* the roughness of practically *all* machined and finished surfaces, *directly in microinches.*
2 It is *accurate and dependable*—even below 3 microinches.
3 It's an easy-to-use SHOP TOOL — built for hard service — reasonably priced — and *thoroughly proven* in *thousands* of production and inspection departments since 1936.
FREE BULLETIN LT14 gives details — shows many typical applications. WRITE TODAY!
Profilometer is a registered trade-mark.
MMC MICROMETRICAL MANUFACTURING COMPANY
341 S. MAIN ST. ANN ARBOR, MICHIGAN

Use postpaid card. Circle No. 235

Free Literature

Free Catalogs and Bulletins

Use the postpaid card opposite page 64 to receive your copy of any of the literature listed on these pages. Just circle the proper number on the card and mail it. We'll do the rest.

Abrasive Cut-Off Machines

Complete line of Campbell abrasive cutting machines is graphically described in a 4-page folder, Bulletin DH-460-B.

These cut-off machines are made in many styles and models, fully automatic and semi-automatic for both dry and wet cutting. Twelve models of varying capacities are pictured in the folder. Specifications such as model number, uses, floor dimensions, speeds, etc., are given in a comprehensive table. Data on Allison abrasive cutting wheels are also listed on the fourth page.

Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn.

Use postpaid card. Circle No. 1

Reinforced Abrasive Products Catalog

A new catalog of reinforced resinoid abrasive products, which have become an essential part of modern foundry, welding, and metal fabrication industries, is being offered by the Bay State Abrasive Products Co. The index is arranged so information on the correct reinforced resinoid wheel may be easily located by picking out the type of operation involved or material to be cut. The three basic types of reinforced products, raised hub disc wheels, abrasive cut-off wheels, and resinoid straight wheels, are described.

Bay State Abrasive Products Co., Westboro, Mass.

Use postpaid card. Circle No. 2

Magnetic Chucks

"Superpower Magnetic Chucks" is the title of a new 24-page catalog issued by Taft-Peirce. Catalog 412 gives advantages of magnetic chucking, lists electromagnetic and permanent type magnetic chucks, magnetic chuck accessories and magnetic work drivers. Sine angle magnetic chucks are available to eliminate clamps and bolts in positioning tricky angle grinding jobs. Rotary chucks are also listed, in addition to a complete range of sizes of conventional types.

Taft-Peirce Mfg. Co., Woonsocket, R. I.

Use postpaid card. Circle No. 3

Surface Grinding

Fourteen unusual surface grinding applications are graphically described in "Case Histories," a new booklet published by the Mattison Machine Works. Included are descriptions of surface grinding being performed by automotive plants, machine tool builders, makers of tool steel products and other metalworkers.

Mattison Machine Works, Rockford, Ill.

Use postpaid card. Circle No. 4

High Intensity Lighting

Stocker & Yale have issued the 4th edition of their catalog of lamps for high intensity localized lighting for all kinds of shop lighting requirements. Models are offered with integral magnifiers for inspection uses, in addition to a full line of fluorescent fixtures with adjustable, flexible or fixed mountings. Special splash-proof fixtures for use on machine tools are featured.

Stocker & Yale, Inc., Marblehead, Mass.

Use postpaid card. Circle No. 5

WHY . . . Should You Measure To MILLIONTHS OF AN INCH?

All gaging authorities agree that it is necessary to gage to an accuracy 10 TIMES GREATER than the desired working tolerance. Therefore, if your tolerances are .0005" or less, you should use a gage accurate to 50 millionths of an inch to assure proper dimensional control. Conventional mechanical indicators cannot maintain, or repeat this degree of accuracy.

Industry is finding the electronic indicator not only more accurate and repeatable, but also less subject to damage than conventional mechanical indicators. In addition, its simplicity of operation enables any operator, who can use a dial indicator or micrometer properly, to measure accurately to millionths of an inch.

Simple And Easy To Read To MILLIONTHS OF AN INCH . . .

The INDI-AC ELECTRONIC INDICATOR is merely set to the required dimension with standard gage blocks. The parts to be gaged are then placed under the gage tip and the meter indicates the variations from the desired dimension MAGNIFIED UP TO 10,000 TIMES! Thus it is far simpler and easier to read than a dial indicator or micrometer.

This versatile instrument is used for all gaging purposes such as surface plate or height gage work, checking setups, runout or alignment of parts or machines.

Using the INDI-AC, tolerances which you now estimate will be easy to work to and measure.

WRITE for further details on the *new* INDI-AC and other Electronic Production Gages, TODAY!

Cleveland INSTRUMENT COMPANY, INC.
731 Carnegie Avenue • Cleveland 15, Ohio

Use postpaid card. Circle No. 236

Carbide Tool Grinders

Catalog 260 describes Hammond carbide tool and chip breaker grinders, including electrolytic, silicon carbide and diamond wheel types. New machines include the SCE-6 oscillating tool grinder, which relieves the operator of the effort of oscillating the tool. Electrolytic grinding power pack can be installed on this and other new Hammond models for faster grinding and reduced diamond consumption.

Hammond Machinery Builders, Inc., 1651 Douglas Ave., Kalamazoo, Mich.

Use postpaid card. Circle No. 6

Barrel Finishing

The Abbott method of barrel finishing combines the tumbling action of a high, narrow barrel with the burnishing and deburring action of steel balls and shapes. The Abbott line of barrels and media are described in this 8-page catalog, which shows applications for the various shapes, such as balls, cones, diagonals, pins and ballcones. Abbott laboratory services are available for test runs on sample parts.

The Abbott Ball Co., 45 Railroad Place, Hartford 10, Conn.

Use postpaid card. Circle No. 7

Variable Pitch Belt Drives

Browning variable pitch drives are based on two types of variable pitch belt sheaves. First is a single groove wide range sheave for "R" and "W" wide range belts. The other is of the locking ring type, for use with single groove and double groove drives, using "Q" and "R" wide range belts for the single groove type and "B" and "C" standard cross section belts for the two-groove type. Catalog contains engineering information and tables of practical stock drive combinations for quick reference.

Browning Mfg. Co., Maysville, Ky.

Use postpaid card. Circle No. 8

CORTLAND ENGINEERING

helps solve your grinding problems

You benefit two ways when you entrust your grinding wheel requirements to us.

First, we see to it that you get wheels and segments exactly suited to your specific needs. We stock most of the standard wheel types in a broad range of grain, grade and structure combinations.

Second, we offer you a top engineering service which has improved grinding wheel performance in many plants. Our engineers have had long and varied experience in the manufacture and use of all types of grinding wheels. We are ready to work closely with you on your grinding problems. Our plant is modern and flexible — able to swing into rapid production of special orders.

A Grinding Wheels Community Since 1880

Although modern machines, methods and laboratory facilities have improved quality and increased production, the same inherent pride of craftsmanship has gone into grinding wheels in this community since 1880. Character of product is no accident at Cortland. It is the result of patient striving to produce the best.

CORTLAND

CORTLAND GRINDING WHEELS CORPORATION
Chester, Massachusetts

11

Use postpaid card. Circle No. 237

GRIND-O-FLEX

the flexible grinding wheel

CAN REACH INTO AREAS

like this

to smooth out draw marks and welds.

Unretouched photo
3" Diameter Wheel

and this

to remove flash and polish for plating

12" Diameter Wheel

Available in various diameters from 3" to 14"

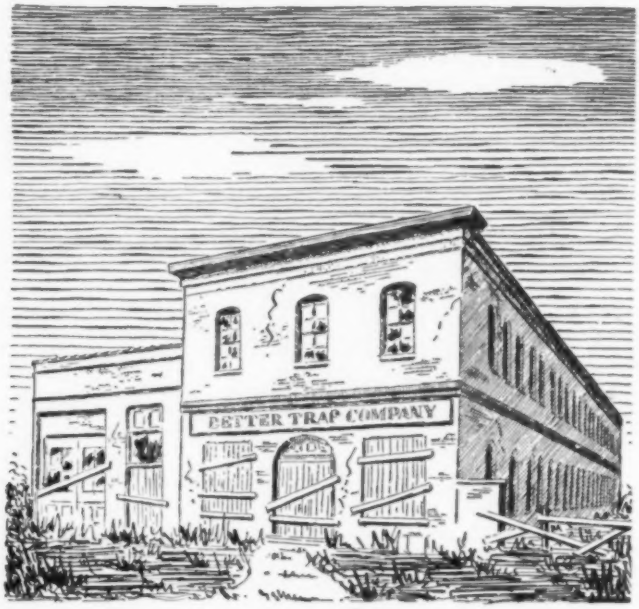
These flexible coated abrasive leaves form themselves to your workpiece and impart a smooth abrasive action.

Wide range of grits available
Wide range of diameters
Amazingly easy to use
Sets up immediately on any light spindle or heavy duty polishing jack

ROUGH STUFF OR FEATHER TOUCH THERE'S A GRIND-O-FLEX FOR YOUR JOB.

Our Engineering Staff can recommend the wheel for your job, and a supply source near you. Write us.

merit PRODUCTS, INC.
4023 Irving Place, Culver City, California
Use postpaid card. Circle No. 238



MOUSETRAP, STEAM TRAP, SEWER TRAP

. . . it makes no difference

. . . the world *won't* beat a path to the door of the man who builds a better one *and then doesn't advertise it* so that people will know about his product, know where it can be bought and how much it costs.

Advertising benefits the buyer, too. It tells you the product story, makes it easy for you to buy. Even more important to you, advertising leads to mass production and volume sales . . . which means lower costs and lower prices.

Yes, "Advertising Benefits You" . . .
'specially businesspaper advertising.

Barrel Finishing Equipment

20-page general catalog of Globe barrel finishing equipment and supplies includes information on all different types of abrasive and burnishing media, and necessary compounds. Also gives important facts about the 6 variables in barrel finishing. Includes before and after photographs of parts which have had deburring, polishing, burnishing, radii forming, rubber deflashing and descaling.

Globe Division of Casalbi Co., Box 411, Jackson, Mich.

Use postpaid card. Circle No. 9

Measuring Comparator

"Measurements to a Micron" gives details of the Model 100 measuring comparator, which can be used for a wide variety of extremely precise measuring operations. The graduated dial which rotates with the precision screw permits accurate readings to a fraction of a micron. The standard instrument is equipped with a 10X eyepiece and a 3.5 objective lens, for a total magnification of 35X.

Paul M. McPherson Precision Instruments, Acton, Mass.

Use postpaid card. Circle No. 10

Abrasive Wheel Net Prices and Data

A comprehensive grinding wheel Net Price and Data Book, No. 6465, has been announced by the Abrasive Wheel Dept., Manhattan Rubber Div. of Raybestos-Manhattan. It lists rubber and resinoid bonded grinding wheels used by industry, and combines them in convenient form. All multipliers are eliminated and the actual consumer net price is shown for all quantities. Scheduled additions for special shapes are adjacent to straight wheel net prices, thus eliminating unnecessary cross reference.

Abrasive Wheel Dept., Manhattan Rubber Div., Passaic, N.J.

Use postpaid card. Circle No. 11

Carbide Gages

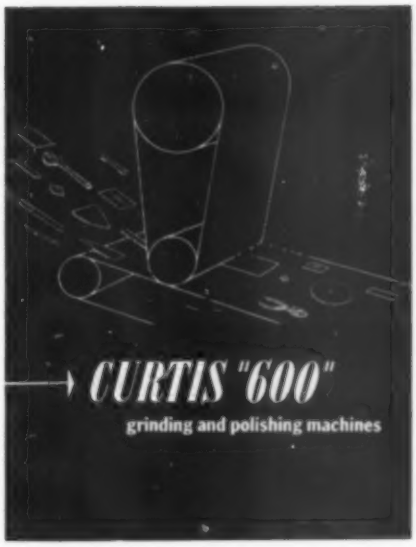
Crafts standard ring and plug gages with carbide inserts are described in new catalog. Plug and ring gages larger than 1.015-in. diameter are supplied with carbide plate applied by the Linde process. Go and not-go gages for all classes of fits are provided.

Arthur A. Crafts Co., Inc., 603 Newbury St., Boston 15, Mass.

Use postpaid card. Circle No. 12

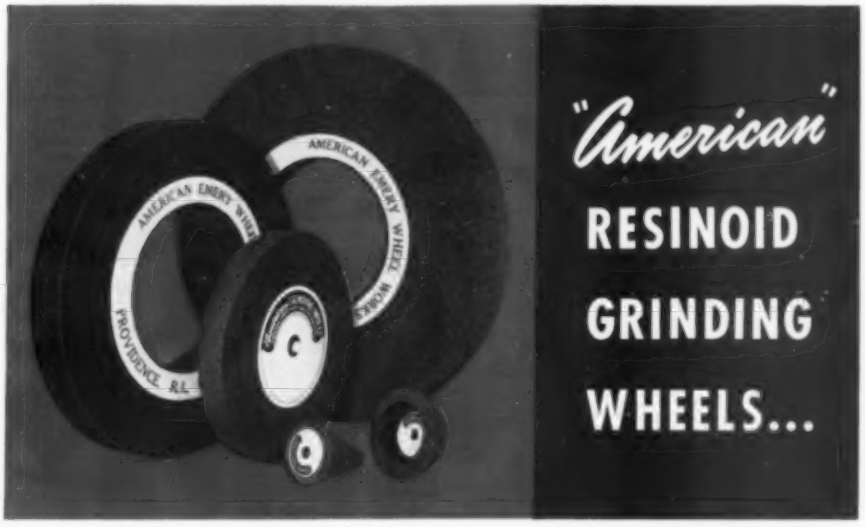
Belt Grinding Machines

Curtis "600" Straight-O-Matic abrasive belt grinding and polishing machines for high production grinding, polishing and deburring of coil, strip, bars, blanks or other shapes are described in new folder. Standard models handle material up to ten inches wide and four inches thick. Grinding heads can be arranged in series to perform consecutive grinding with only one material handling.



Curtis Machine Division, The Carborundum Co., Jamestown, N. Y.

Use postpaid card. Circle No. 13



for high speed snagging . . . *at a PROFIT!*

"American" Resinoid Grinding Wheels have an outstanding reputation for heavy snagging in foundries where their high speed cutting makes real savings in labor, power, and overhead costs. They have established many performance records on stand grinders, swing grinders and portable grinders.

"American" Resinoid Grinding Wheels are available in a wide variety of abrasives and structures, or if you wish, we can make your wheels special for any particular foundry job.

It will pay you to investigate the money saving advantages of "American" Resinoid Wheels for most efficient snagging and billet grinding.

Write for our illustrated bulletin.

Write AMERICAN EMERY WHEEL WORKS
RED BRIDGE · · PROVIDENCE 1, R. I.

SPARK UP YOUR PROFITS WITH "American" GRINDING WHEELS

Use postpaid card. Circle No. 239

Steel Grit Blasting

"Steel Grit Provides Bright-As-A-Penny Non-Ferrous Finishes" tells how to produce lustrous finishes on non-ferrous metals like brass, aluminum or bronze by airless abrasive blasting. Plants are using steel grit abrasives in place of more conventional ones to achieve more lustrous finishes on these metals. Case history material from three different companies is included, with photos of typical parts processed by the method.

Wheelabrator Corp., 1169 S. Byrkit St., Mishawaka, Ind.

Use postpaid card. Circle No. 14

Automatic-Cycle Gear Checker

Bulletin No. 481-A describes a new automatic-cycle gear checker, designed particularly for aircraft and special-purpose spur gears. The unit quickly measures and records parallelism, tooth taper and tooth spacing. Readings are automatically and permanently recorded in two colors by a built-in recorder for easy evaluation. Accuracy, through a two-channel electronic circuit, is to 0.0001 in.

Michigan Tool Company, 7171 E. McNichols Rd., Detroit 12.

Use postpaid card. Circle No. 15

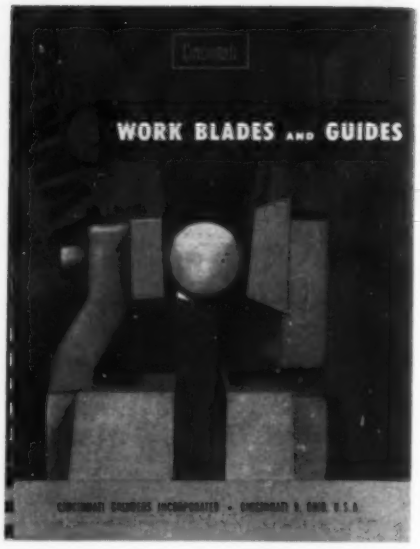
Abrasive Snagging Wheels

"Abrasive Snagging Wheels for Steel Mills and Foundries," 12-page bulletin from Simonds Abrasive Co., now contains information about the new Simonds "IL" bond for resinoid snagging wheels. Special chemicals added to conventional resinoid bonds provide an internal lubricant which increases cutting action while extending wheel life.

Simonds Abrasive Co., Tacony and Fraley Streets, Philadelphia 37, Pa.

Use postpaid card. Circle No. 16

Diesel Fuel Injector Parts Get Precision Flatness, Finish and Parallelity on Lapmasters®
. . . here's why and how
"John Crane" Lapmasters are taking over the highly critical and essential job of making diesel fuel injectors absolutely leak-proof—and doing it at a considerable reduction in cost over previous methods.
Both engine shops and injector manufacturers have found the Lapmaster a highly successful machine tool for obtaining the required flatness and finish on the mating surfaces of valve nozzle bodies, holders and spacers . . . have found they can run any combination of parts best suited to their production requirements . . . have reduced inspection and rework to the vanishing point.
Lapmasters consistently produce flatness to less than one light band (11.6 millionth of an inch) surface finishes of 2 to 3 RMS on practically every kind of material including all ferrous metals, magnesium, aluminum, brass, carbon, ceramics and plastics.
There is a correct size Lapmaster for your requirement. Investigate the possibilities of this modern machine for your work.
FREE DATA
Send for these three booklets which describe in detail how to produce and measure precision flatness and finish.
ARROWS SHOW MATING SURFACES LAPPED
John Crane
MECHANICAL PACKINGS
SHAFT SEALS
TEFLON PRODUCTS
LAPPING MACHINES
THREAD COMPOUNDS
CRANE PACKING COMPANY
6417 Oakton Street, Morton Grove, Illinois (Chicago Suburb) In Canada: 617 Parkdale Ave., Hamilton, Ontario
Use postpaid card. Circle No. 240



Work Blades and Guides

"Work Blades and Guides" is a new comprehensive catalog covering blades and guides for Cincinnati Filmatic centerless grinders and centerless lapping machines. The book gives instructions for the selection of the proper blade material, blade angle, thickness and size, and for setting guides and blades. An adequate selection of work blades and guides is vitally necessary to obtain maximum performance from centerless operations.

Cincinnati Grinders Inc., Cincinnati 9, Ohio.

Use postpaid card. Circle No. 17

Hand Feed Surface Grinder

Gagemaster Model 2HF 6 x 18 hand feed surface grinder is described and illustrated in new bulletin from H. Leach Machinery Co., Providence. Intended for toolroom or production use, the machine features centrally located handwheels at operator level.

H. Leach Machinery Co., 387 Charles St., Providence 4, R. I.

Use postpaid card. Circle No. 18

Roof Ventilators

8-page catalog describes redesigned line of power roof ventilators. Bulletin describes construction, operation, performance data, fan speeds, motor horsepower, certified delivery ratings of the four models in the American Blower line.

American Blower Corp., Detroit 32, Mich.

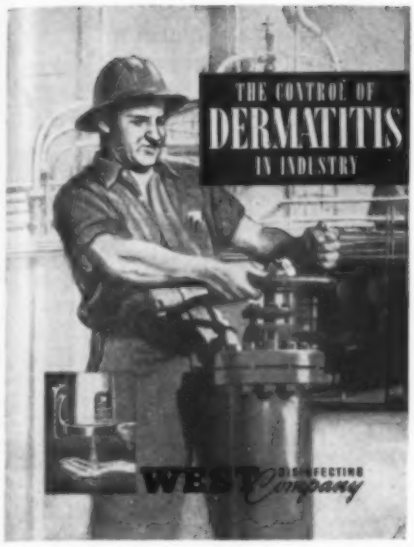
Use postpaid card. Circle No. 19

Cylindrical Grinders

Landis Tool Company has issued a new 28-page condensed general catalog of standard and single purpose cylindrical grinders. Important specifications of all models are included.

Landis Tool Co., Waynesboro, Pa.

Use postpaid card. Circle No. 20



Dermatitis Prevention and Control

A 24-page booklet, "The Control of Dermatitis in Industry," has been published by the West Disinfecting Co. It describes the causes and types of industrial dermatitis as well as a complete program of preventive measures against more than 190 skin irritants, including those common in grinding and finishing. Preventive measures discussed: antiseptic protective creams, special hand cleaners, cutting oil additives, antiseptic soaps and protective garments.

West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y.

Use postpaid card. Circle No. 21

Surface Grinder

Bulletin describes Bridgeport Surf-Ace grinder, capacity 6 x 16 x 11½ (under a 7-in. wheel). Spindles offered are sealed motorized types—Ex-Cell-O, Pope, or Whitnon—of 1 hp. Handwheels are at waist level. Wet grinding and dust collecting accessories are available.

Bridgeport Surf-Ace Grinding Machine Co., 315 Asylum St., Bridgeport, Conn.

Use postpaid card. Circle No. 22

Engineering Services

A new eight-page illustrated folder describes extensive tool, die and machine design; production engineering and product design and development services for industrial and metalworking plants.

A unique product producibility study and manufacturing cost analysis method is offered by the company to help management accurately predict costs before making large capital expenditures.

Engineering Service, Inc. of America, 21460 W. Eight Mile Rd., Detroit 19, Mich.

Use postpaid card. Circle No. 23

DI-MET

Carbide Microinch Finisher

The answer to low cost finishing of carbide and ceramic cutting tools!

Produces ½ to 6 microinch finishes in 2 minutes or less!

Here's what micro finishing of cutting tools can do for you!

1. Increases tool life from 200 to 700%
2. Raises cutting speed (sfm) 50 to 100%
3. Increases feed and depth of cut 50 to 100%
4. Decreases surface roughness of parts 100 to 500%

The DI-MET Carbide Microinch Finisher employs two Meehanite cast iron laps. Impregnated with DI-MET Diamond Compound, these laps can be used in sequence for fast rough lapping and finish lapping, or when both are impregnated with same grade of diamond compound, can be used simultaneously for finishing with double the output.

DI-MET DIAMOND COMPOUND

A *better* lapping and finishing compound that won't throw off under centrifugal force, that polishes faster and easier, and that produces uniform finishes free from scratches. Water soluble for ease of cleaning and changing grades. A demonstration will prove its extraordinary value!

ANOTHER PRODUCT OF TELKEE RESEARCH
di-met CORPORATION

DI-MET CORPORATION
TORRANCE, CALIFORNIA

Ask for free folders on the DI-MET CARBIDE MICROINCH FINISHER AND DI-MET DIAMOND COMPOUND!

Use postpaid card. Circle No. 241

Diamond Wheels and Tools

New 32-page catalog describes and illustrates enlarged line of metal and resin bonded diamond wheels and tools. A wide choice of properties in wheels and tools is available. Metal bonded wheels, which are said to have an open, porous structure, are recommended where coolant is available, giving a claimed four to six time increase in wheel life over resin bonded wheels. Catalog No. 717.

Delta Diamond Wheel Corp., 1403 Utica Ave., Brooklyn 3, N.Y.

Use postpaid card. Circle No. 24

Brushes, Brushing Machines

"Brushes for Industry" is the title of a complete 100-page illustrated catalog just issued by The Osborn Mfg. Co., Cleveland. The plastic bound volume contains detailed information on how to select and use power brushes, Brushamatic machines, as well as other industrial brushes. Brush selection charts aid in engineering applications of brushing techniques.

The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

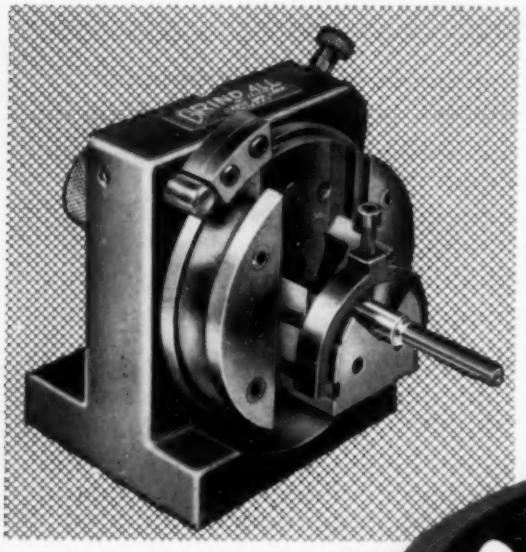
Use postpaid card. Circle No. 25

Tumbling Compound

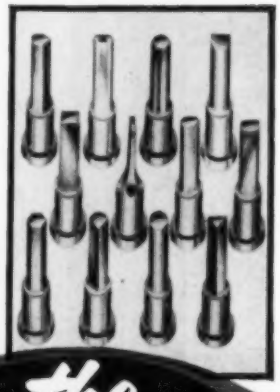
Organ-Tu liquid tumbling compound can be used with all types of grinding and polishing media — synthetic and natural chips and metal shapes. It works first as a water conditioner. Then it acts to clean the media and parts and keep them clean. Produces long-lasting suds for the suspension of abrasion particles.

Folder may be obtained from the Finger Lakes Chemical Co., Inc., Etna, N.Y.

Use postpaid card. Circle No. 26

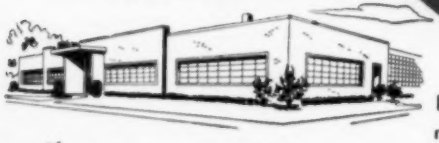


Perforator Grinding
±.0002 with greatest speed accuracy and range



the Grind-All FIXTURE

made by the house that precision built



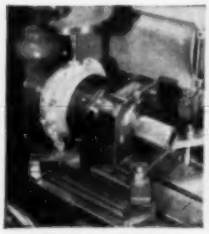
Headquarters for the Finest... Precision Tools

Here is higher accuracy, greater range and maximum speed in grinding perforators. Meets the requirement for a more versatile perforator grinding attachment. Grinds many irregular shapes concentric with shank.

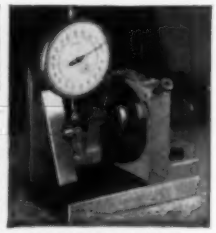
Also performs other functions such as light milling and boring fixture, inspection tool, etc.

Consult our engineering staff when you need precision tools or dies. Send for free catalog.

Harig Manufacturing Corp.



BORING FIXTURE



INSPECTION TOOL

Use postpaid card. Circle No. 242

Lead Testing Comparator

Bulletin illustrates portable lead testing comparator for quick and accurate checking of thread errors by inspecting from one flank angle or centralization between both flank angles of thread. The comparator is set to conform to the master or precision screw. Once set, the operator holds the gage's two contact points to the screw and takes a dial reading.

Jerpbak-Bayless Co., Solon Road, Solon, Ohio.

Use postpaid card. Circle No. 27

Inch-Millimeter Conversion

Newly-designed Decimal Inch and Millimeter Conversion Chart is of interest and use to engineering and shop men because of increased international exchange of engineering data. Chart not only permits conversion of fractional inches into decimal and millimeter equivalents at a glance, but also shows conversion of decimal millimeters into inch decimals.

Opto-Metric Tools, Inc., 137 Varick St., New York 13, N.Y.

Use postpaid card. Circle No. 28

Spin Testing Machines

New illustrated Bulletin No. 756 covers the "Autospeeder" spintest machine for automatic one-at-a-time testing of abrasive cut-off saws and grinding wheels up to 15,000 rpm. Also Day high speed hydraulic presses with automatic density and dimensional control, and other presses for special metal-working applications.

The George L. Day Co., 1227-31 Niagara St., Buffalo 13, N.Y.

Use postpaid card. Circle No. 29

Flat Finishing Service

Folder describes flat steel finishing service offered on a jobbing basis by Production Finishing Corp., Detroit. Pre-polishing to remove imperfections and produce desired finish on steel before forming operations is featured part of service, as well as special application work, grinding extrusions, sizing and deburring. Upgrading commercial cold rolled to a fine finish is another important service, as well as finishing stainless steel.

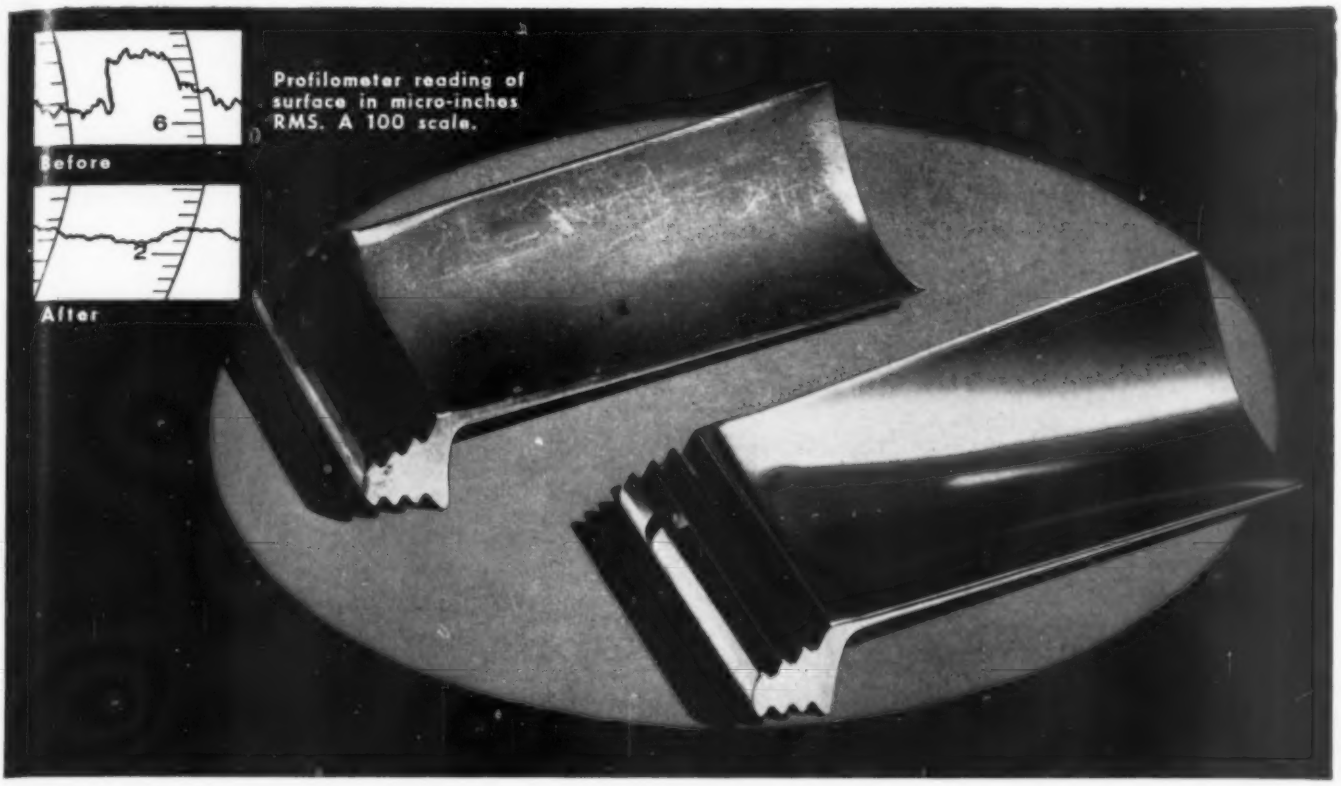
Use postpaid card. Circle No. 30

Small Machine Lubrication

Automatic and semi-automatic centralized lubrication systems for a wide range of small machines are described in Bulletin No. 4C. It presents extensive line of cyclic and one-shot lubricators, discusses factors to be considered in selecting the proper lubricator for a specific machine.

Bijur Lubrication Corp., 515 W. Passaic St., Rochelle Park, N.J.

Use postpaid card. Circle No. 31



Cut parts finishing costs, maintain exact tolerances, get absolute uniformity with *Roto-Finish* processes

Roto-Finish, pioneers in precision barrel finishing, offer you a complete finishing service. Savings on deburring, descaling, grinding, polishing, coloring and surface improvement are tremendous. Expensive hand finishing methods can be eliminated.

Roto-Finish processes are controlled to produce the finish you need with no significant dimensional changes. You get absolute uniformity of finish in quantity lots.

Many prominent manufacturers now using Roto-Finish processes are saving money on finishing costs. (Names on request).

ROTO-FINISH CHIPS, COMPOUNDS AND MACHINES ARE OF THE HIGHEST QUALITY

Roto-Finish has never sacrificed quality for the sake of price. Through the years, Roto-Finish has carried on a continuous program of process and product improvement to meet the needs of modern industry. When you choose Roto-Finish processes, you can be sure that you are getting the best in supplies, equipment and complete continuing engineering service.

ROTO-FINISH GUARANTEES RESULTS

There is no costly trial and error involved in the purchase of Roto-Finish equipment. You submit unfinished parts to Roto-Finish along with a finished sample and a description of the finish you require. These sample parts are processed in the Roto-Finish Sample Processing Laboratories, where experienced engineers determine the combination of chips, compounds, and machine required to do the job. Roto-Finish guarantees to reproduce the same results in your plant, using the Roto-Finish processes, that are achieved in sample processing. This service demonstrates for you exactly what you can gain by using Roto-Finish processes.

The sample processing service is available to help you with your finishing problem. Take advantage of this opportunity to save on finishing costs. Send samples of finished and unfinished parts and details of the type of finishing equipment available in your plant.

SEND FOR THIS FREE TECHNICAL DATA FOLDER

It describes the basic process, chips and compounds and the complete Roto-Finish line of standard and special machines.

Roto-Finish COMPANY

3730 Milham Road, Kalamazoo, Mich.

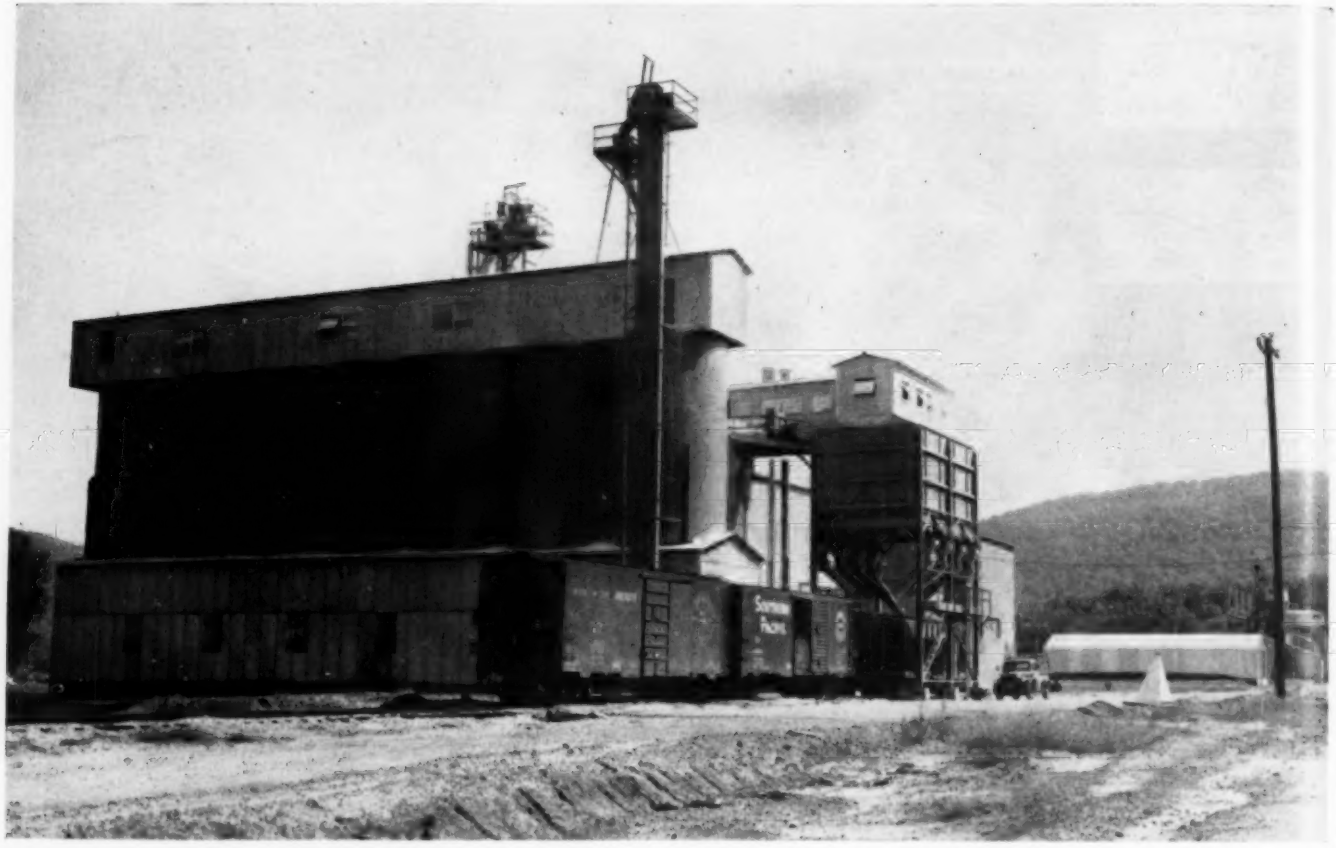
P. O. Box 988

Phone: FI 3-5578

FOREIGN REPRESENTATIVES:

AUSTRALIA — A. Flavell Ltd. — 89 Tulip Street — Cheltenham
BRAZIL—Commercial E. Industrial de Fornos Werco, Ltda.—rua General Gurjao, 326—Rio de Janeiro
CANADA—Canadian Hanson & Van Winkle Co., Ltd —Cor. Silver and Morrow Avenues—Toronto
ENGLAND — Roto - Finish Limited — Mark Road, Hemel Hempstead — Hertfordshire
FRANCE — Societe Roto - Finish — 40-42 rue Chance Milly — Clichy (Seine) — Paris
GERMANY, AUSTRIA, NORWAY, SWEDEN, SWITZERLAND — Metallgesellschaft A. G. — Reuterweg 14 — Frankfurt a. M. — Germany.
HOLLAND, BELGIUM, LUXEMBURG — N. V. Roto-Finish Maatschappij — Rotterdamseweg 370 A. Delft, Holland.
ITALY — Societa Roto - Finish a R. L. — Sesto S. Giovanni — Viale E. Marelli, 31 — Milan
SPAIN — Instituto Electroquimico, S. A. — Corcega 58 — Barcelona

Use postpaid card. Circle No. 243



Electric Furnace plant for the fusing of magnesium oxide at the new Norton Company, Huntsville, Alabama, site. In background at extreme right is the boron carbide electric furnace plant. Other units include office and laboratory.

Norton Unveils Alabama Electric Furnace Plant

$2¼ million facility to make boron carbide, fused magnesium oxide, fused zirconia, and fused alumina. Aluminum oxide and silicon carbide production to be added later. Much of new plant's output slated for use in atomic energy programs.

● Norton Company officially opened its new Huntsville, Alabama, electric furnace plant in dedication ceremonies on December 10, 1956. Although the majority of the company's present electric furnace products are abrasive materials for use in grinding wheels and other abrasive tools, the output of the Huntsville plant will consist at first of materials such as boron carbide, fused zirconia, fused magnesium oxide, and fused alumina, which find extensive application in the field of atomic energy. These materials are becoming increasingly important to American industry because of their ability to withstand extremely high temperatures and wear.

At a later date, facilities for making aluminum oxide and silicon carbide may be added. Huntsville was picked as the site of the new facility for several reasons, principally because of the abundance and low cost of electric power. Norton has purchased 195 acres in the Huntsville area. The availability of good workers and the congenial attitude of the community were other factors influencing the choice of location.

Edward D. Porter is resident manager of the Huntsville plant, which at the present time employs about 60

people. Mr. Porter has been with Norton Company since 1948, when he joined the research and development department. Since 1955, he has been associated with the production department.

The Huntsville plant is operated by the company's Electro-Chemical Division, headed by Howard J. Daly, vice president and general manager. Two other electric furnace plants are operated by Norton Company in Chippawa, Ontario, and Cap-de-la-Madeleine, Quebec.

The operations at the Huntsville plant are primarily the electrical fusing of raw materials to make the chemical products, which are then sent to the Worcester plant for further processing. Some of the products made at Huntsville will be sold directly to other industrial users.

Boron carbide, which is made here, was originally developed about 20 years ago. Although it is extremely hard, its use as an abrasive in grinding wheels is not practical because it breaks down too quickly. It is used as a loose abrasive for polishing. It is often used in polishing dies to conserve the more expensive diamond powder which is used in the final polishing operation. One extensive use of boron carbide, trade-marked Norbide by Norton Company, is in sandblast nozzles. The material has also been used as a wear resistant material for facing precision gages.

With the coming of the atomic era, boron carbide was found to have other extremely useful properties. It is an excellent absorber of neutrons. Therefore, it has been used in making the control rods of atomic reactors. It is also used as a shielding material. Its relatively light weight is another property which is often useful in atomic work.

Fused zirconia is a relatively recent Norton development (1951). This refractory material can be molded into shapes, such as bricks, or used as a loose grain for protection against temperatures up to 4400°F. It has chemical properties which permit it to be used as a refractory material in many applications where other refractories would react with the material being processed. Fused zirconia is also the starting raw material for the chemistry in making zirconium metal. In its most recent application, fused zirconia is molded into thin rods, melted in a special flame gun and sprayed onto surfaces as a protection against high temperatures under certain conditions. In this application, it is known as ROKIDE "Z" spray coating. ROKIDE "A" coating, made with aluminum oxide, is more common for this work. ROKIDE spray coatings, developed by Norton Company, are used for protecting nozzles in rockets from the intense heat of the exhaust gasses. It has also been used to protect jet engine parts.

Fused magnesium oxide is another special refractory material. One of its most common uses is in the heating elements of electric stoves. It provides electrical insulation between the heating coils and the heavy outer shell on which the cooking utensils set. While it provides excellent electrical insulation, it readily passes the heat.

Fused alumina is used in making a lightweight castable refractory, recently developed and made available to industry by Norton Company. • • •

Aerial view of Norton Company's Huntsville, Ala., plant.

Simple, Easy Way to Do Spark Testing

Spark testing steel is a common occurrence in many steel warehouses, automotive plants and large stock rooms of industrial manufacturers. It is by this method that much of the steel used today is graded and selected for further processing.

One of the easiest ways to do this is to use a hand grinder. It is easy to handle, light in weight and powerful enough to throw a sufficient spark stream to instantly establish the grade of steel tested. Compact size makes storage no problem. Or, it might be used for other work, such as deburring, filing, smoothing weld seams, cleaning castings or for internal grinding.

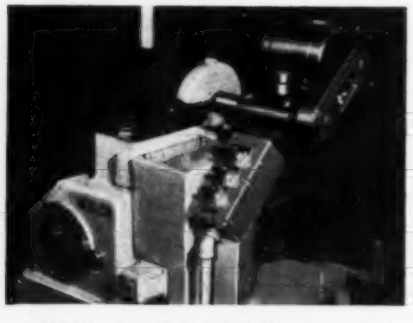
The hand grinder used in the steel bin above is the Series 9, Dumore Hand Grinder. This handy tool was especially developed by Dumore to handle such plant jobs as spark testing. While it can be used for a great many other grinding jobs, its power-packed performance and perfect light-weight balance makes it ideal for this work. The ¼ hp fan-cooled, universal motor develops 15,500 rpm and swings ⅞" to 2-5/16" wheels. Extension arbor and ¼" chuck permit a wide range of work uses, both internal and external, with mounted wheels and burrs. Although powerful enough to handle the tough jobs, it weighs only 7½ lbs. For further information on this and other job-proved Dumore hand grinders for production, maintenance or tool room work, write to The Dumore Company, 1326 Seventeenth Street, Racine, Wisconsin.

are you making the most of your DUMORE TOOL POST GRINDER?

VERTICALLY MOUNTED ON BRIDGEPORT MILLING MACHINE, a Dumore Tool Post Grinder provides an ideal high speed precision grinding head for use with small mounted wheels, points or carbide burrs.

MOUNTED ON UNIVERSAL GRINDER, a Dumore Tool Post Grinder finishes an internal section of a Jacobs chuck.

MOUNTED ON USED MILLER BASES, Dumore Tool Post Grinders provide a Chicago manufacturer with dependable high production, precision grinding equipment at an astonishingly low cost.



SPECIAL CUT-OFF MACHINE automatically sizes piston ring springs. Machine was easily made at low cost with a Dumore Tool Post Grinder to carry the cut-off wheel.

It mounts on *any* basic machine to provide low-cost, precision grinding equipment for production, maintenance or tool room needs!

Whenever precision of fit or finish is essential, and tooling cost is a vital factor, portable Dumore Tool Post Grinders will provide the complete answer. Lathes can be turned into external or internal cylindrical grinders. Planers, millers, and shapers can become surface grinders. Special grinding and cut-off machines can be built at amazingly low cost!

Simplified mounting is the secret of quick change-over—it also speeds re-converting to original set-up. Dumore Tool Post Grinders are continuous duty rated for high production. They consistently deliver precision to .0001" tolerances with surface finishes of 6 to 8 micro-inches. There's a complete line of nine models, ¼ to 3 hp, for every size of basic machine and type of grinding job.

Catalog 55 FL gives complete details, write for your copy.

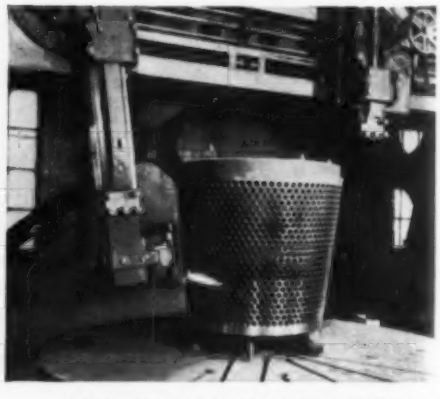
SOLD BY LEADING DISTRIBUTORS EVERYWHERE . . .

You can do more grinding with Dumore Grinders on **any** machine tool!

DUMORE
PRECISION TOOLS

1326 Seventeenth Street • Racine, Wisconsin

AUTOMATIC DRILL UNITS
TOOL POST and HAND GRINDERS
MICRO-DRILLS



MOUNTED ON RAM OF A BORING MILL, a Dumore Tool Post Grinder solves the tricky problem of grinding a high finish on perforated, tapered, cast-iron strainer cores.

Use postpaid card. Circle No. 244

What's New in Equipment and Materials

New Equipment and Materials

Use the handy postpaid card opposite page 64 to receive more information on any of these products. Just circle the proper number on the card and mail it. We'll do the rest.

Ex-Cell-O Jet Vane Grinder

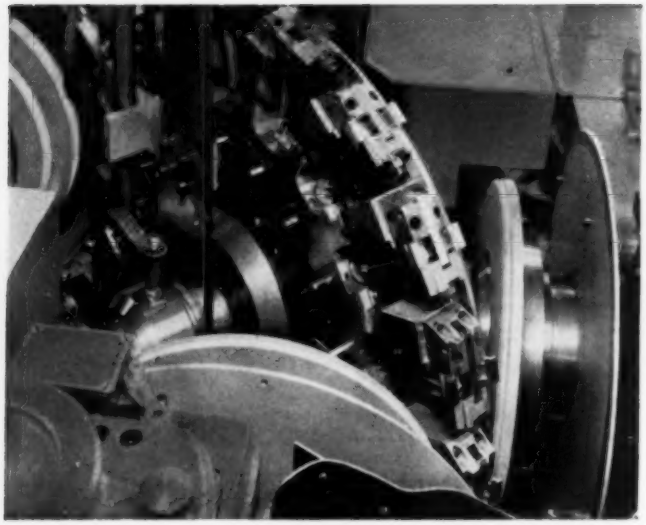
A new three-slide grinder which automatically finishes the curved surfaces of jet engine vane roots has been designed and built by Ex-Cell-O for large aircraft engine builders.

The machine is equipped with four grinding wheels mounted on three spindles. Two of the spindles each carry a single wheel, while the third spindle carries two wheels. Three of the wheels are 15" in diameter; the fourth is 20". Wheel widths range from ½" to 1¾".

Each slide is equipped with an Ex-Cell-O cam-type universal diamond dresser, which shapes the respective wheels as part of the automatic machine cycle. Slides automatically compensate for abrasive removed when the wheels are dressed. Slide movements include rapid approach, an adjustable fine feed and an adjustable spark-out period.

Two interchangeable trunnion fixtures are furnished with the machine to permit nearly continuous operation. While one fixture rotates the vanes through the grinding cycle, the second fixture is being loaded by the operator. Loading racks support the trunnions

New Ex-Cell-O three-slide grinder for grinding curved surfaces of jet engine roots. Heavy lines in inset sketch indicate five basic surfaces ground in one cycle; O.D., two edges, and I.D. on both sides.



This view shows vanes in the trunnion fixture, two grinding wheels in the right foreground, also two wheels on one spindle in the upper left background.

when these are out of the machine.

The fixtures shown here hold nineteen vanes; more or less than this number can be ground per machine cycle depending upon the size and shape of the vanes. • •

Use postpaid card. Circle No. 101

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 725 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6 Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

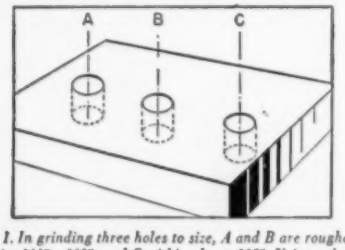


Fig. 1. In grinding three holes to size, A and B are roughed to within .001"–.002", and C within about .005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

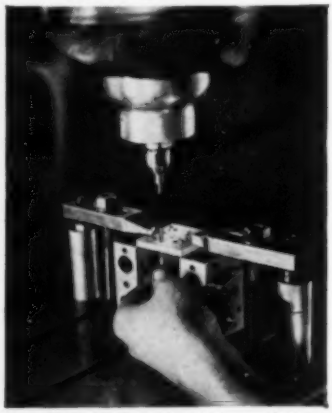


Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 725 Union Ave., Bridgeport 7, Conn.

Use postpair card. Circle No. 245

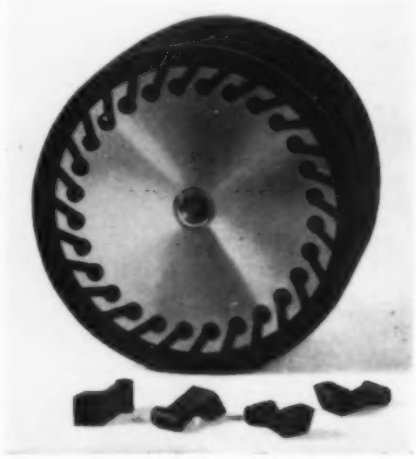
Expanding-Type Grinding Wheel Has Interchangeable Segments

A series of separate, replaceable rubber segments grip the coated abrasive sleeve of the Flexcore, a new expanding grinding wheel offered by Nu-Matic Grinders, Inc., of Cleveland.

The interchangeable segment feature provides two distinct operating advantages. As segments become worn or damaged, they can be replaced singly or in groups at a very low cost. The core never needs to be replaced. Formerly, expanding type wheels had to be scrapped when a single segment was damaged.

Segments are available in a variety of hardnesses and can be used in any combination to attain different cutting actions. For example, a fast cutting action is achieved by using hard segments and soft segments in alternate slots.

The "Flexcore" is designed so that complete peripheral contact is made with the coated abrasive band. Nu-Matic states that this provides greater holding power on the abrasive band so that the wheel can be operated at much slower speeds than is possible with conventional expanding wheels. Each segment is anchored in the metal core by a key slot and cannot fly off the wheel even if the abrasive band ruptures.



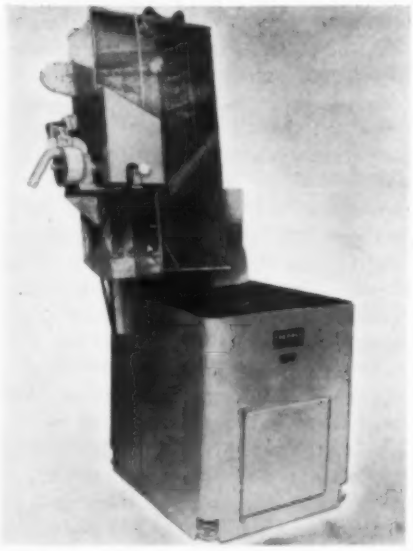
To replace a segment, one simply slides the old segment out of its keyed slot and inserts a new segment. Replacement segments are sold by the hundred, and a complete set of new segments for an average size wheel costs only $3.50.

Wheel diameters of 3", 4", 5" and 6" are included in the new line. Widths are made to any specifications. The new line of grinding wheels uses the same length abrasive bands as Nu-Matic's "Aircore" inflated grinding wheels of the same diameter.

Nu-Matic Grinders, Inc., 8224 Carnegie Ave., Cleveland 3, Ohio. •

Use postpaid card. Circle No. 102

Feeder Transfers Trunnion Cups to Centerless Grinding Operation



Utilizing the Model 2200-B elevating hopper feeder with 4 cu. ft. hopper capacity as the basic feeder, Feedall, Inc. has designed a mechanism to feed trunnion cups to a centerless grinding operation. Previously trunnion cups, because their diameter is larger than their length, would not readily feed in a sliding position. In the improved transfer mechanism perfected by Feedall, the parts are transferred from the rolling position to a sliding position by an intermittent motion and fed into an electronically controlled gravity chute from where they are fed into the grinder at a continuous rate. The complete package built by Feedall consists of storage hopper, conveyor, orienting-selecting mechanism, transfer mechanism and discharge chute.

Work range for rolling parts is 3" in diameter by 3/16" to 1" in length; for sliding parts, 3/16" to 1" in diameter by 3" in length.

Feedall, Inc., Willoughby, O. •

Use postpaid card. Circle No. 103

Control Units for Electrolytic Grinding

Anocut Engineering Co., Chicago manufacturer of electronic controls for electrolytic grinding, has just recently marketed its new 1,000 and 3,000 ampere automatic, electronically controlled power supply units. With the high powered units, larger grinding wheels can be effectively utilized on the machines and much more rapid stock removal rates can be achieved with the larger wheels and faster speeds possible. This is an ideal combination for production line work on sensitive metals and precision parts that are difficult to grind conventionally. The new power units can be attached to most of the good quality grinding machines now in use with just a few basic modifications. Modifications necessary for converting are explained in Anocut's Bulletin No. 300, a copy of which will be sent upon request.

Anocut Engineering Co., 531 W. Washington Blvd., Chicago 6, Ill. •

Use postpaid card. Circle No. 104

Stainless Steel Actuator

Designed to operate within a temperature range from minus 67 degrees F. to plus 600 degrees F., a new all-stainless steel actuator is being offered by Ex-Cell-O Corp.

The actuator is hydraulically operated over a range of pressures from 0 to 3000 psi. It can also be adapted to pneumatic operation to meet the requirements of certain installations.

Prototypes, such as the actuator pictured here, have a stroke of 7". They are 16" long and 2-3/8" in diameter. However, the basic design of the actuator can be altered to suit specific performance and space envelope requirements as specified by the customer. This actuator uses no "O" rings. Instead, it is designed to incorporate high temperature seals.

Engineering data is now available. Ex-Cell-O Corp., Aircraft Div., Detroit, Mich. •

Use postpaid card. Circle No. 105

HAMMOND MODEL VRRO
Two-Spindle Variable Speed Lathe

STEP UP PRODUCTION — REDUCE FINISHING COSTS with Hammond DOUBLE SPINDLE LATHES

- No "down time" for one operator when the other changes wheel — each operator has his own motor, control and variable speed drive.
- Convenient Variable Speed dial is within arm's reach of the operator — no "climbing" around in back to change speeds.
- Wheel economy and better finish. As wheel wears each operator can increase speed — to maintain constant peripheral speed for uniform and better finish, maximum production and wheel life.
- Available in 3 sizes — two 5 HP, two 7½ HP or two 10 HP.

ALSO AVAILABLE IN WIDE SWING MODEL VRROW

Wide swing construction, with extended bearing housings and spindles, provides additional working space for large, bulky pieces.

Cost reduction is the need of the day — Write for catalog.

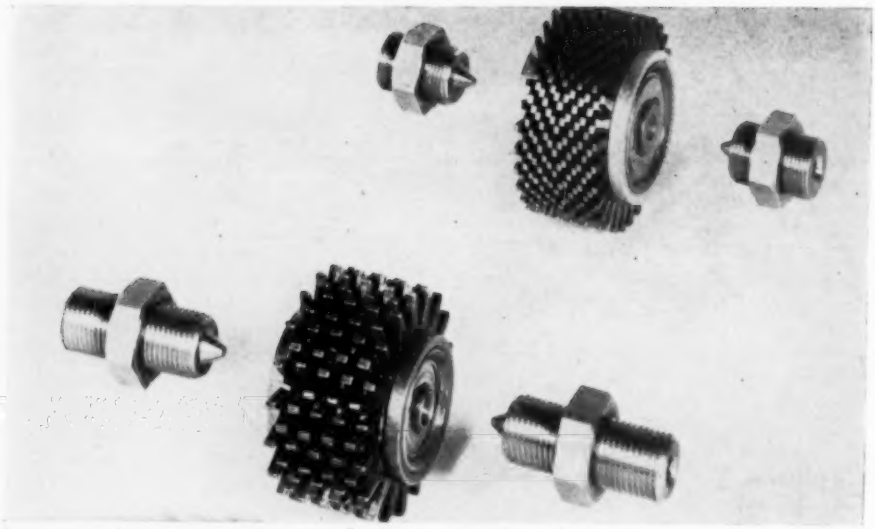
Hammond OF KALAMAZOO "Good Machinery Since '82"

Hammond Machinery Builders Inc.

DOUGLAS AVE. — KALAMAZOO, MICHIGAN

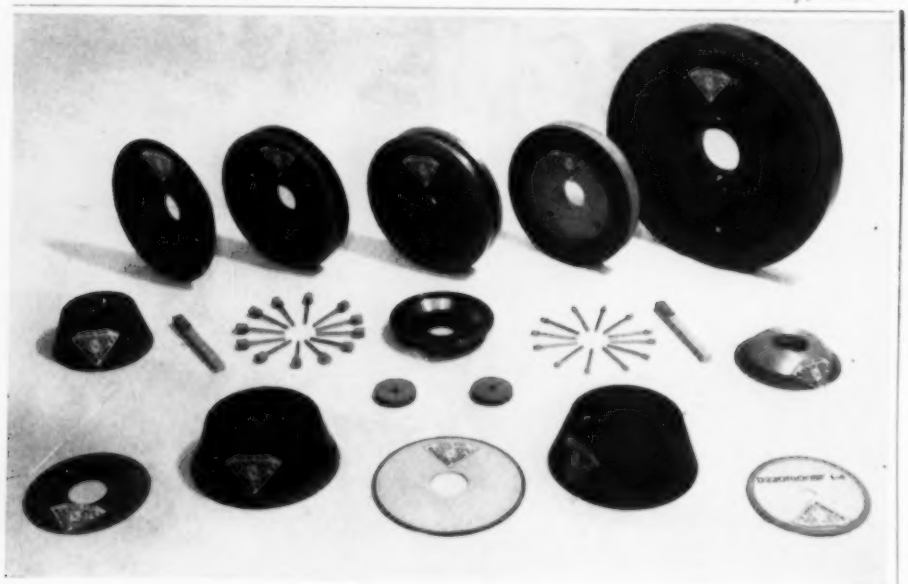
SEE US AT BOOTH 165 WESTERN METAL SHOW—LOS ANGELES—March 25-29.

Use postpaid card. Circle No. 246



Inner Construction of New Wheel Dressers Eliminates Need for Square Arbors and Keyways

The Aer-O-Matic wheel dresser is now made available for Besly, Hanchett and Mattison Grinders to give the finest in dressing performance with lower cost.



Because of the dressers exclusive inner construction, the need for square arbors and keyways which are used to hold the cutters in place on the spindle in other dressers of this type, are completely eliminated. The "too soon" worn out spindle need not be replaced long before the cutters themselves are worn.

Other added features include a threefold bearing protection, guaranteeing bearing life for the full life span of the dresser and longer. This is due to a method of unit and bearing lubrication designed to keep dirt and grit out, lubricant in. Shields placed over the bearing seals are added to prevent any lapping action to the seal caused by coolant oils mixed with abrasive grain, thus the bearing seal remains to perform its function of protecting the bearing against dust and grit.

Bearings are mounted on a single shaft with centers which is incorporated in the dresser. The center point mounting studs are fitted into this shaft. The tightening adjustment load is absorbed by the shaft and not by the bearings, eliminating any bearing mis-alignment and stress causing bearing freeze up before the dresser is used or worn.

There are two units as shown for finishing or roughing operations and both are available with spacers, if desired. All units fit the standard mountings or holders on the above mentioned machines.

Aer-O-Matic Tool Co., 5059 W. Diversey Ave., Chicago 39, Ill. •

Use postpaid card. Circle No. 106

Cooling Compound for Cutting and Grinding Aluminum Does Not Stain or Discolor

Aluminum can be machined or ground without stain or discoloration using a straight oil compound developed by the International Chemical Co., Philadelphia, Pa.

Called International Compound No. 1231-A, this stain-free coolant is said to possess excellent lubricating properties which protect both the work and moving parts of the machine.

According to the manufacturer, International No. 1231-A penetrates to the point of contact swiftly and prevents premature loading of the wheel. This same anti-welding action increases the life of cutting tools by virtually eliminating the welding of chips or "bugs" on the tool. Chips are drained off continually.

International Chemical Co., Dept. GF, 2628 N. Mascher St., Philadelphia 33, Pa. •

Use postpaid card. Circle No. 107

ACE OF DIAMONDS brand diamond wheels frontrunners for excellence in American Industry. Assures you of the finest—maintained through modern facilities and rigid standards. ACE OF DIAMONDS a name to remember!!

Products of over 30 years experience

MANUFACTURERS OF:

Resinoid - Metal - Vitrified Diamond Wheels

Powdered Metals Allied Products

TELEPHONE: CEnter 9-4602

THE PAUL L. KUZMICK CO.

271-279 GROVE AVE., VERONA, N. J

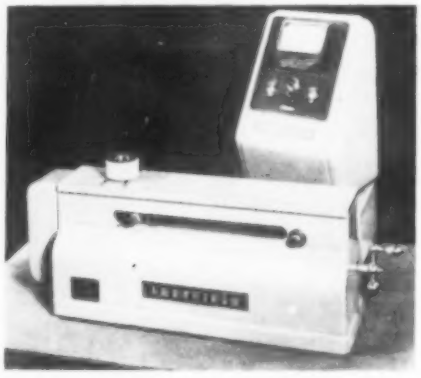
Use postpaid card. Circle No. 247

New Sheffield N-7 Internal Measuring Instrument

A new electronic gaging system unaffected by line voltage fluctuations is incorporated in Model N-7 internal measuring instrument manufactured by Sheffield.

The N-7 Internalchek is a heavy duty shop and laboratory instrument for inspecting internal diameters of ring gages and other parts for size, taper, bellmouth and out-of-roundness. Standard capacity is from .370 to 12" with vertical capacity to 1½". Special gaging arms can be obtained to provide gaging range from .240 to 12" with vertical capacity to 1".

The instrument is available with dual electronic amplification of either 1000/2000; 2500/5000; 5000/10,000 to 1. Amplifications within each dual range can be switched from one to the other without realignment of the indicating meter mechanism. With 5000/10,000 amplification, direct reading to ten millionths (.000010) can be made on the graduated 4" zero center equilinear scale. Also interpolations to five millionths can be made.



New Sheffield N-7 Internalchek internal measuring instrument.

Both bench and floor type models are manufactured. An auxiliary cooling-off table (12" x 18") for both gage blocks and work is available as an accessory with the floor model. Additionally, this accessory has a bracket which holds the gage block case at an easy-to-see and easy-to-reach angle.

The "Accutron" amplifier has a highly stable electronic circuit which is unaffected by line voltage fluctuations from 65 to 150 volts. Indicator response is instantaneous and readings are consistently repetitive. Power requirement is 110 volt 60 cycle A.C. The amplifier can be obtained with an optional outlet for connecting a meter reading recorder or other types of instruments.

The Sheffield Corp., Dayton 1, Ohio. •

Use postpaid card. Circle No. 108

How DOUGLAS

saved 25,000 manhours!

With SPEED-D-BURR PRECISION BARREL FINISHING*

An Incredible $140,000.00 in Dollar Savings!

Time consuming handwork, production delays, difficulty in controlling uniformity and high costs in deburring a wide variety of parts in short runs was a problem faced by Douglas Aircraft. Turning to precision barrel finishing as a possible solution, a survey of various types of equipment and sample lot testing of many parts followed. SPEED-D-BURR engineers recommended a 4 unit installation to begin production *(picture above)*. Within a few weeks, savings began to mount, parts were being turned out faster than ever before and close tolerance finish quality was greatly improved on widely diversified parts from a 30" long casting to small washers—all in the same SPEED-D-BURR installation. Time study records indicated that projected manhour savings would reach 25,000 for the year with a dollar savings of $140,000.00 *(more than 10 times the equipment cost)*.

Like to read the whole story? Ask for Speed-D-Burr Folder DA-1...

ALSO WRITE FOR CATALOGS:

- *How to Cut Production Costs 80% or More*
- *The Futurama Series*
- *The Mity-Mite Series*
- *Media and Compounds*
- *Hot Sawdust Barrels*
- *Handling and Separating Equip.*

**As told in Iron Age Magazine — August 2, 1956*

ONE SAVINGS EXAMPLE

Part No. 5638557-3

Hand Deburr . . .	$11.25 each
Speed-D-Burr . . .	.50 each
SAVINGS	$10.75 each

This is just one of many parts on which exceptional savings were made using SPEED-D-BURR Precision Barrel Finishing.

Service Is Our Most Important Product . . . It Does Not Cost . . . IT PAYS!

SPEED-D-BURR CORPORATION
PRECISION BARREL FINISHING
DESIGNERS • ENGINEERS MANUFACTURERS

THE WORLD'S MOST COMPLETE LINE OF PRECISION BARREL FINISHING EQUIPMENT & SUPPLIES

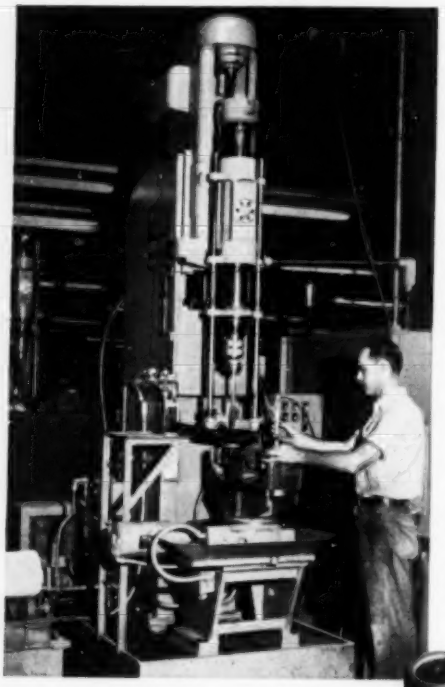
SPEED-D-BURR CORPORATION
3613 SAN FERNANDO RD., GLENDALE 4, CALIF.

Distributorships available in some key areas . . . to complete our national sales network.

Use postpaid card. Circle No. 248

WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.

CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____

TITLE_____

COMPANY_____

STREET_____

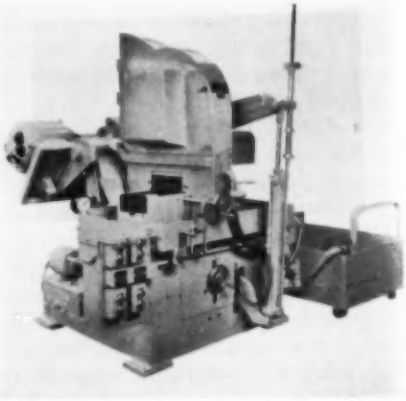
CITY_____ ZONE____ STATE____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Use postpaid card. Circle No. 249

Wet Abrasive Cutoff Machine

Designated the Model 481, this we abrasive oscillating cutting machin cuts large diameter bar stock, tubin and other shapes, ferrous and non ferrous metals including corrosion resisting steel as well as hardened o annealed steels of practically all anal yses.



Manufactured by the Campbell Machine Div., it is equipped with a 26-inch diameter Allison abrasive cutting wheel. It is said to cut practically any metal within its capacity of 8-in. square solids with a minimum of burr.

The Model 481 is an oscillating type machine in which wheel feed and work clamps are hydraulically operated and the work bar is hand fed. Through its oscillating motion, the amount of abrasive wheel contact is materially reduced and cutting is performed with a minimum of wheel pressure.

The machine's spindle is mounted at the abrasive wheel in a double row oversize ball bearing and at the opposite end in a double row self aligning roller bearing. Both ends of the housing are equipped with labyrinth type seals to exclude dirt and moisture.

The wheel guard is permanently fixed to the bed of the machine and entirely encloses the wheel except for openings on either end for entry of work. This feature assures complete operator safety. A hinged door provides quick access to the abrasive wheel. Splash guards protect against coolant splash for the full range of material sizes.

A large separate coolant tank permits easy removal for chip cleaning. Separate compartments settle out the sludge and keep the coolant clean. The coolant is pumped through a hose into the front of the wheel guard. An adjustable coolant box equipped with baffle plates assures thorough and equal wetting of both sides of the abrasive wheel and guidance of coolant to the critical cutting area. Control of coolant is by means of a shut-off valve.

The Model 481 is furnished with a 25 hp, 1800 rpm, totally enclosed, fan cooled motor to drive the abrasive

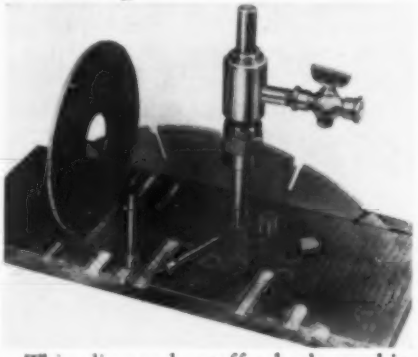
wheel, with multiple V-belt drive. The unit measures 100 in. in length, 85 in. in width and 84 in. in height. Net weight, with electrical equipment, is approximately 6800 lb.

Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn. •

Use postpaid card. Circle No. 109

Diamond Wheels

Starlite Industries, Philadelphia, offers a complete line of diamond wheels and tools for grinding, cutting, and drilling. A segmented diamond cut-off blade with diamonds in a carbide matrix has been developed for plastics, laminated fibreglass, Mycalex, and other hard and abrasive materials. Regular type segmented cut-off wheels—diamond with a metal matrix—are available for masonry, stone and concrete cutting.



Thin diamond cutoff wheels, as thin as .005-in., are intended for laboratory glass work, crystals, germanium, quartz, laminated fibreglass, etc.

Cup, periphery and other types of Starlite Magnicon bonded wheels and diamond mounted points are available. Starlite Industries, 58 & Market, Phila., Penna. •

Use postpaid card. Circle No. 110

Directory of Manufacturer's Representatives

The 1957 Verified Directory of Manufacturer's Representatives is an 8½x11, 195-page book published as a guide to sales executives in selecting representatives for their marketing programs. The Directory lists 14,000 manufacturers' domestic and foreign representatives in the U.S. and its territories and Canada. Listings are arranged geographically and include the principal products each "rep" carries and the trading area covered. Price of the directory is $20.00. Manufacturers' Agent Publishing Co., 505 Fifth Ave., New York 17, N.Y.

Use postpaid card. Circle No. 111

PRODUCTION NOTE

Please turn to pages 6 and 7. This is what you should have seen on pages 14 and 15 of our January issue instead of what appeared there.

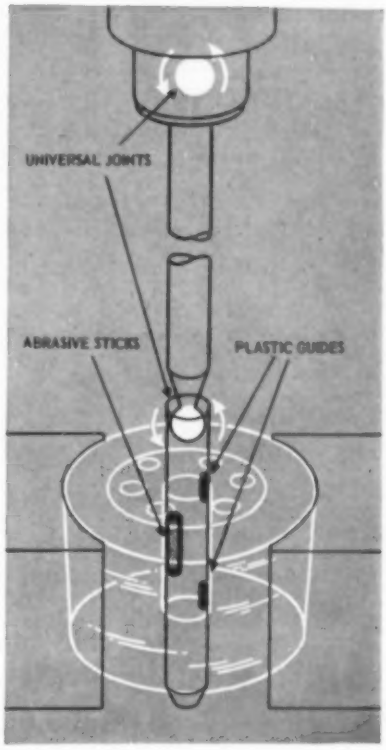
HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.

For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.



The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE ____ STATE _____ D

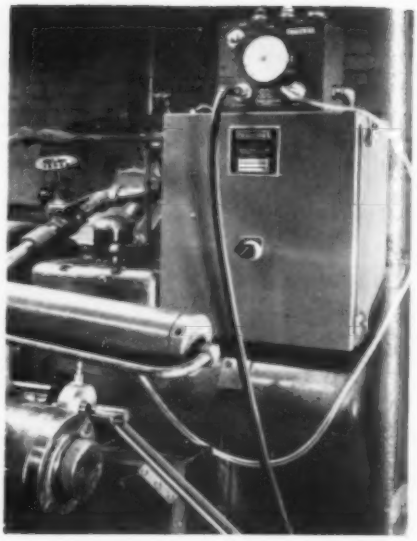
MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Use postpaid card. Circle No. 250

Continuous Measuring Gage For Centerless Grinders

A continuous measuring gage for centerless grinding machines has been announced by Federal Products Corp., Providence, R. I. This newly developed gage, known as Series 493-CG, continuously measures the output of various type centerless grinders, and visually indicates any trend toward out-of-tolerance work so that as many as three or four machines can be adequately supervised by a single operator.

So that the gage will respond to workpiece size only, ignoring local irregularities such as spaces between workpieces, oil holes, annular grooves, etc., the gage incorporates time delay response which is adjustable in accordance with the speed of work travel and piece length. This time delay provision produces a steady uninterrupted signal which clearly indicates the condition of the work. It does not interfere with detection of trend toward borderline work size. Large lights on top of the meter-switch unit provide this indication. The gage can also be equipped with audible signals, if desired.



Indicating limits can be set within the spread of the tolerance so that the operator will be signalled before any oversize or undersize work is produced. The indicating dial is graduated in .000050" and the air-electric system used in the gage permits indicating limits to operate consistently within plus and minus five millionths of their established settings.

The gage is comprised of standardized components and is normally supplied with an air snap gaging head which can be equipped with various size spacing blocks to suit a variety of work sizes. Alternately, it can be equipped with an air ring gaging head, as shown in the illustration.

Both types of heads provide non-contact measurement which places no drag upon the work, thus avoiding the possibility of work pile up at the wheel which could cause serious damage.

Federal Products Corp., 1144 Eddy St., Providence, R. I. •

Use postpaid card. Circle No. 112

Chicago Wheel Power Hand Tool

Chicago Wheel and Mfg. Co. announces the development of an all-new Hi-Torque Handee, Series 6000. Among the many new features of the tool are extra speed and power, streamlined design, larger air vents to permit increased air velocity for cooler operation, larger oilite bearings for longer life, and all-new built-in chuck lock for quick change of accessories.

The new Hi-Torque Handee was developed for use as a complete hand workshop for machine shops, tool and die plants, foundries and household maintenance, as well as for the master craftsman, homecrafter and hobbyist. It weighs 14 ounces and operates at 25,000 r.p.m. for grinding, cutting, carving, drilling, sanding, sawing, engraving, polishing, cleaning and burnishing. The tool works in wood, hardened steel, non-ferrous metals, glass,

Arter "Jigmatic" will do ALL your positioning . . . and *do it fast*

Check These Features...

- No stops
- No gauge rods
- Only SECONDS to change tapes
- MINUTES to set up
- No more than 11 tape holes to punch per position
- 600,000,000 possible positions. Hundreds of positions per single set-up
- Automatic magnetic locking
- Accuracy — plus or minus .001"
- Unidirectional approach at minimum speed
- Simultaneous operation of both coordinates

The 20"x30" ARTER has them all

ARTER GRINDING MACHINE COMPANY

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

Use postpaid card. Circle No. 251

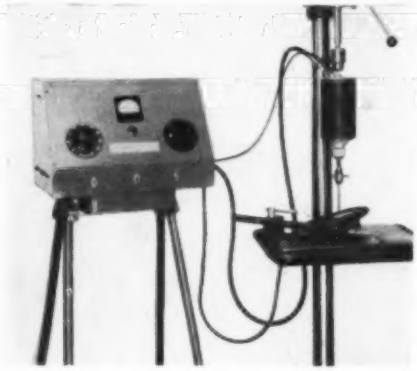
ceramics and plastics. The Hi-Torque Handee is available for operation at 110 or 220 volts, 25 to 60 cycles, AC or DC, and has a complete set of all-purpose accessories and steel carrying case.

Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill. •

Use postpaid card. Circle No. 113

Electric Disintegrator Cuts Hard Metals

Model C-56 Cammann Disintegrator machine was designed primarily for removing broken taps, reamers, studs, set screws, ejector pins, bushings, etc. However, it is presently being used for cutting—dovetails in hardened dies and tools, new centering holes in taps, internal and external keyways and slots, oil holes, pilot holes thru taps, reamers, etc.



The machine can be hooked up to any drill press offering convenience and maneuverability.

The Cammann Mfg. Co., Inc., 2700 Henninger Rd., Cleveland 9, O. •

Use postpaid card. Circle No. 114

Electro Refractories Introduces Fibreglass-Reinforced Wheels

Two new fibreglass-reinforced resinoid grinding wheels, said to have superior strength, have been introduced by Electro Refractories & Abrasives Corp. after two years of research and field testing.

One is a foundry cut-off wheel available in diameters up to 20 inches. The other is a depressed center type wheel that comes in seven and nine-inch diameters.

The cut-off wheel can be used on steel alloys and non-ferrous castings for tuck pointing, masonry cutting, concrete slotting, wire cable cutting and general purpose cut-off work.

Designed for grinding normally hard-to-reach spots with portable units, the depressed center reinforced wheel has many applications. It can notch castings risers for knock-off, deburr, slot, clean welds and perform light snagging and clean up operations on fabricated steel structures. •

Use postpaid card. Circle No. 115

New Buff Developments

United Buff Products Corp. has announced their new Type "K" and Type "Q" pressure-cooled buffs to their distributors.

The units have been developed especially for finishing of die castings or permanent mold castings. Action of the buffs is such that they tend to remove excessive buffing compound residues from parts being buffed, leaving a cleaner finish preparatory to the plating cycle. Samples are available.

United Buff Products Corp., 233 Oak St., Passaic, N. J. •

Use postpaid card. Circle No. 116

A Coolant that Won't Stain Aluminum!

INTERNATIONAL 131-A

For grinding and cutting aluminum, International 131-A out-performs on every count. This stain-free coolant does not discolor aluminum or its alloys, nor does it react with aluminum dust. A superior finish is assured. In addition, the need for wheel dressings is greatly reduced . . . tool life is substantially increased.

It will pay you to use International 131-A—one of a complete line of non-staining International coolants and cleaners formulated especially for aluminum and other non-ferrous metals.

Write for information today

Specialists in Cleaners and Coolants for Over 50 Years

I.C.C. INTERNATIONAL CHEMICAL CO.
2628 N. MASCHER STREET • PHILADELPHIA 33, PA

Use postpaid card. Circle No. 252

COOLANT or GRINDING COMPOUND PROBLEMS?

here's your Solution

INTERNATIONAL REFINING & MFG. CO. ACCRUS EVANSTON, ILL. U.S.A.

NOW you can...

- produce low micro-finishes with 60 grit grinding wheels —EXCELUS MICRO FINISH Grinding Compound;
- accomplish deep draws without fractures or wrinkling — INTERNATIONAL DRAWING COMPOUNDS;
- hob gears without oily floors, undesirable working conditions—NEW ACCRUS;
- draw No. 40 B&S magnet wire at 5000 FPM trouble free—ACCRUS No. 4.

43 Years Old - BUT NOT Old Fashioned!

Our products are time tested and modernized to meet today's requirements.

Our field engineers work with industry, solving critical production problems through proper use of coolants, lubricants and drawing compounds.

What are your problems?

...Call on us!

INTERNATIONAL

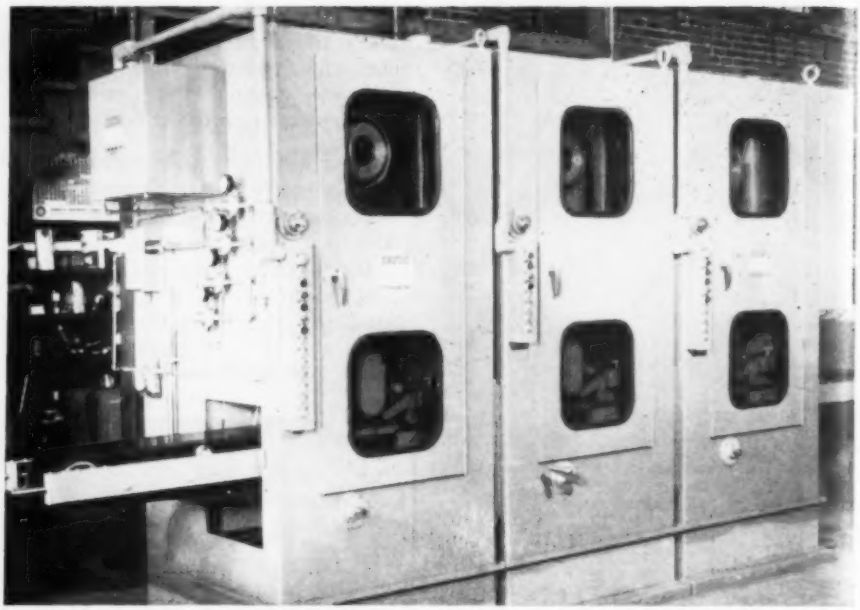
Refining & Manufacturing Co.

1914 — 1957

EVANSTON ILLINOIS

Use postpaid card. Circle No. 253

Curtis Straight-O-Matic Belt Grinders



The Curtis Model R600C-3 Straight-O-Matic employs three abrasive belts over one conveyor belt and is equipped with wet grinding, oil mist applicator, automatic tracking and pneumatic tensioning of the ten inch wide abrasive belts. The unit makes possible a three grit polishing sequence, a three step stock removal for sizing, or combinations of polishing and grinding.

Straight-O-Matics are being used for small electronic and business machine parts, automotive parts, saw blades, floor tile, extrusions and many other applications. The neoprene rubber conveyor belt allows for relatively close tolerance work. One user reports holding tolerance of ± .001 on business machine parts. Fixtures, when required, can be easily attached to the conveyor belt.

Curtis Machine Div., The Carborundum Co., Jamestown, N.Y. •

Use postpaid card. Circle No. 117

Chain Conveyor Makes 180° Turns on 5″ Radius

Announcement of a newly developed corner, adjustable to 180° turn on as small as a 5″ radius, for horizontal turns and vertical turns to 128° has been made by Chain-O-Flex Corp.

Using these corners, a conveyor can be adapted to almost any floor space or processing requirement. Adjustments of corners can be made on the job.

The corners are used in conjunction with Chain-O-Flex continuous Conveyor-A-series. This conveyor consists

of link chain moving in steel tubes—a greatly simplified construction with a minimum of moving parts. Standardization of drives offers 3 sizes for economy. Drive units are available with single speed or three to one infinite variable speed adjustment.

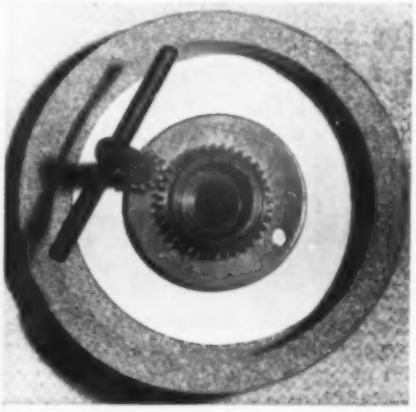
Systems up to approximately 350 ft. and loads up to 30 lbs. per ft. are practical with one Chain-O-Flex drive. Conveyor hooks may be spaced as close as 6" centers. Top and bottom vertical turns and horizontal turns, track clamps and chains are stock items.

Chain-O-Flex Corp., 3334 Lincoln Ave., Franklin Park, Ill. •

Use postpaid card. Circle No. 118

Grinding Wheel Mounting

Gearnuts, products of Glare Mfg. Co., Detroit, are said to facilitate the mounting of recessed wheels, cup wheels and rubber wheels, on surface grinders, cutter grinders and small O. D. grinders. An operator using the gearnut method can lock the nut without touching the wheel. The unit replaces the spanner wrench commonly used, and provides controlled tension for lining up diamond wheels.



Gearnuts are said to eliminate "wheel breakage, skinned knuckles and wasted time" in mounting wheels. They fit all standard 1¼ x 16 adaptors, right or left-hand thread.

Glare Products Co., Box 4876, Redford Station, Detroit 19, Mich. •

Use postpaid card. Circle No. 119

Simonds IL Bond Wheels for Fast Cutting, Long Life

Steel mills, foundries and industry in general can now obtain snagging grinding wheels combining the fast cutting action of softer grades with the long wear of hard wheels, according to Simonds Abrasive Co. Simonds' recent development, IL Bond, acts as an internal lubricant, increasing the abrasive cutting action of resinoid bonded wheels.

This difference in the cutting action of IL Bonded wheels actually begins in the wheel mix with the addition of

special chemicals and compounds to conventional resinoid bonds. For grinding wheel users whose present cutting rate is satisfactory, the new IL Bond in harder grade is said to give longer wheel life. Where wheel life is satisfactory, IL Bond in the same grade will provide increased cutting action. Both of these advantages have been demonstrated in tests of IL Bonded wheels on semi-automatic and regular swing frame grinders and on floor stands and portables. New IL Bond is available with Simonds Red Streak Flanges for heavy duty snagging.

Simonds Abrasive Co., Tacony and Fraley Streets, Philadelphia 37, Penna. •

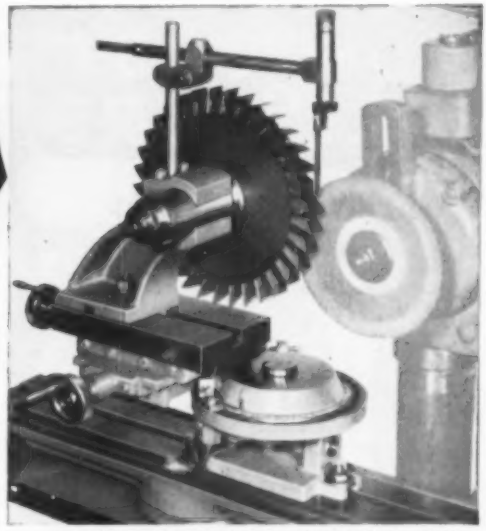
Use postpaid card. Circle No. 120

Be sure and circle the proper number on the postpaid card. You mail the card, we'll do the rest.

THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)

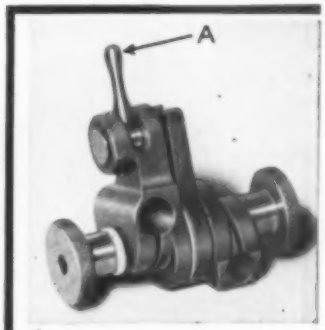


▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 603

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.

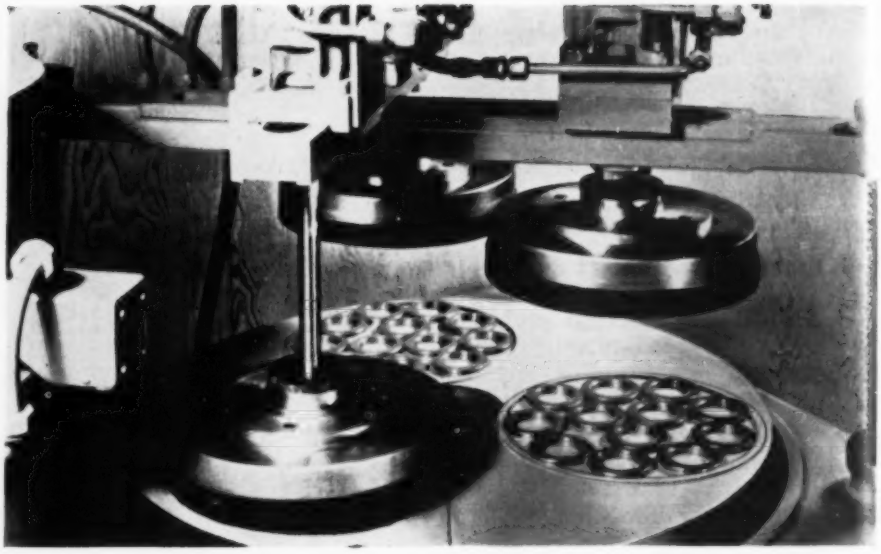


▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

Use postpaid card. Circle No. 254

Production Polishing Equipment for Lapmaster Lapping Machine



Production polishing accessories and equipment are now available for conversion of the Model 24 Lapmaster lapping machine into a high speed polishing unit.

Tooling consists of a special lap plate and pneumatic lifts. Also the addition of sponge neoprene pads to the pressure plates, 4/0 polishing paper discs and double sided sensitive tape for mounting the polishing paper to the lap plate. Conversion can be readily accomplished in the plant.

Using the 4/0 polishing paper, the machine is especially recommended for parts requiring low RMS finishes. It assures a high production rate without generating heat to distort parts. Flatness can generally be held under 3 light bands. Typical materials, together with finished polish readings are: Soft steel (to 3-4 rms.) and hard steel, stainless steel and brass (to 2 rms.).

To obtain closer finish, as well as polishing parts such as carbon, glass filled Teflon, Bakelite and similar materials, an alloy polishing plate would generally be recommended.

Crane Packing Co., Dept. GFN, 6400 Oakton St., Morton Grove, Ill. •

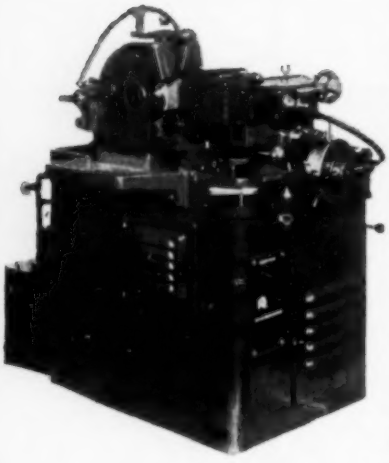
Use postpaid card. Circle No. 121

LOW COST GRINDERS

RIBON UNIVERSAL GRINDERS

Electro mechanical and hydraulic models produced by one of Europe's largest grinder manufacturers—completely universal with swinging internal grinding heads. 14" x 2" x 5" O.D. wheel with 3 H.P. and 18000 and 35000 I.D. spindles with 1½ H.P. Long conical adjustable plain bearings in both wheelhead and workhead with automatic pressure oil bath lubrication. All machines have automatic table traverse and infeeds.

11"x20" Electro Mechanical Grinder	$3450.00 fob N.Y. or Chgo.
11"x32" Electro Mechanical Grinder	$3650.00 fob N.Y. or Chgo.
11"x42" Electro Mechanical Grinder	$3850.00 fob N.Y. or Chgo.
12"x20" Hydraulic Plunge Cut Grinder	$5950.00 fob N.Y. or Chgo.



CENTRI CENTERLESS GRINDERS

Close tolerance production units capable of .0001" tolerances in production. Long conical adjustable plain bearings on both grinding wheel and feed wheel spindles with pressure oil bath lubrication. Equipped for bar feed, thru feed, and infeed work with automatic ejectors and automatic cycling on infeed where desired. Diamond or crush dressing on both wheels with contour form and taper dressing of wheels by either hand feed screw or hydraulically.

MODEL 0 Work diameters .012"-5/8" ($1950.00 fob N.Y. or Chgo.) 10x2½x5 wheel with 2½ H.P.

MODEL 1 Work diameters .016"-2"($3450.00) 12x4x5 wheel with 7½ H.P.

MODEL 3 Work diameter .030"-3" 16x8x5 wheel with 16 H.P. Hydraulic Dressing of wheels and hydraulic automatic Variable cycling for infeed ($6475.00)

THE AMERICAN HERFORDER CORP.

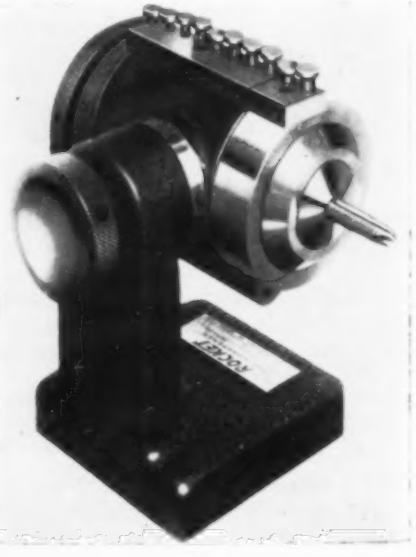
1801 W. COLUMBIA AVE. CHICAGO, ILLINOIS

Use postpaid card. Circle No. 255

Tap Sharpener Handles 4, 5, and 6 Flute Taps

Rockford Die & Tool Works, Inc. announces a new 60 Series tap sharpener which will sharpen 4, 5, and 6 flute taps. The 60 Series has increased collet capacity to a maximum of 2¼ inches, and supplements the present 50 series which handles 2, 3, and 4 flute taps with a maximum collet capacity of 1-1/16 inches. Sharpeners for additional flute capacities and special collets are available on special order.

Push buttons control the radial relief and provide indexing. The head is quickly adjusted by means of a knurled knob from 0 to 90 degrees angle to the grinding wheel.



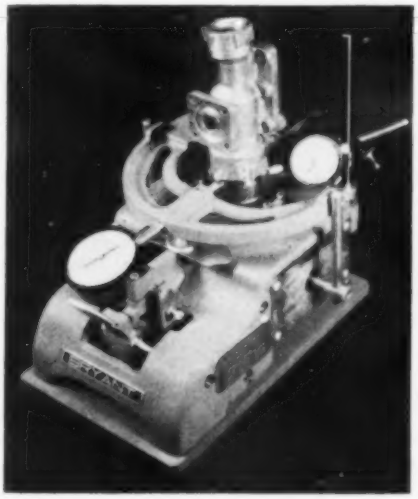
Designed to sharpen either left or right-hand taps, the sharpener requires only about 45 seconds to set up or change taps, and does the sharpening in minutes. It can be used on any surface grinder with a magnetic chuck or bolted to the work table.

Rockford Die & Tool Works, Inc., 1816 Seventeenth Ave., Rockford, Ill. •

Use postpaid card. Circle No. 122

Concentricity Attachment

A newly designed concentricity attachment to be used in conjunction with the Bryant B-21 bench gage is now being manufactured by the Bryant Gage & Spindle Div., Springfield, Vt. The attachment checks concentricity of small internal conical surfaces in relation to a thread on aircraft parts and similar work pieces.



Work part in position on gage.

In the illustration shown, an internal conical surface approximately 3/4" in diameter and 1/16" wide is being checked in relation to a 1-5/16-12 internal thread. Checking is done by a pivoted pin follower which contacts the conical surface and transmits any eccentricities of the surface to a dial indicator. A ball slide follower is incorporated into the concentricity attachment to compensate for thread progression and to allow checking the conical surface through one or more full turns of the work part. The size of the internal thread is also checked at the same time. •

Use postpaid card. Circle No. 123

Abrasive Spheres for Barrel Finishing

Norton Company has just announced a new barrel finishing media, Tumblex "S" abrasive spheres. The spheres come in five different diameters and are made of Norton Alundum aluminum oxide abrasive.

The new spheres are said to be ideally suited for barrel finishing hard-to-contact recesses or intricate shapes. They have proved a very satisfactory medium for finishing tubing, coil springs, scissor handles, bearing retainers, pump bodies and many other parts where conventional tumbling abrasive tends to wedge or will not reach. The spheres are exceptionally dense and long lasting, providing good cutting action with economy.

Norton Co., Worcester 6, Mass. •

Use postpaid card. Circle No. 124

Production CENTERLESS

GRINDING & FINISHING MACHINE

Remove stock faster at lower cost

Production's abrasive belt principle provides a better grinding and finishing method by centerless operation, rapid change of setup and elimination of wheel dressing. • This Production machine features reversible traverse and uniform accurate removal of stock on round or tubular parts. For example, the Model 914 illustrated rough grinds bi-metal valve stems to a tolerance of +.003", −.000" with stock removal from .020" to .035" IN A SINGLE INFEED OPERATION AT LOWEST MANUFACTURING COSTS. Automatic cycling and control put skill in every worker's hands. • Our Demonstration Laboratory is ready to process a sample lot of your parts. Get the complete Production Story, NOW! Write Department D.

PRODUCTION MACHINE CO., Greenfield, Mass., U.S.A.

Use postpaid card. Circle No. 256

News of the Industry

Mattison Takes Over Mercury Grinders

New addition of Mattison Machine Works, Rockford, Ill., permits building of giant surface grinders. Addition totals 16,800 square feet. New structure is 50 feet high, 240 feet long, and 70 feet wide. There is 35 feet of clearance under the 30-ton overhead crane that travels the entire length of the new building. Added head room and floor space gives Mattison facilities to build and assemble larger capacity grinders.

Mattison Machine Works, of Rockford, Ill., has taken over the manufacturing rights for the line of heavy duty grinders formerly produced by Mercury Engineering Co., Milwaukee. Mattison closed purchase of the Mercury line on December 31 from the Milwaukee concern, which will now devote its entire facilities to making paper converting machinery.

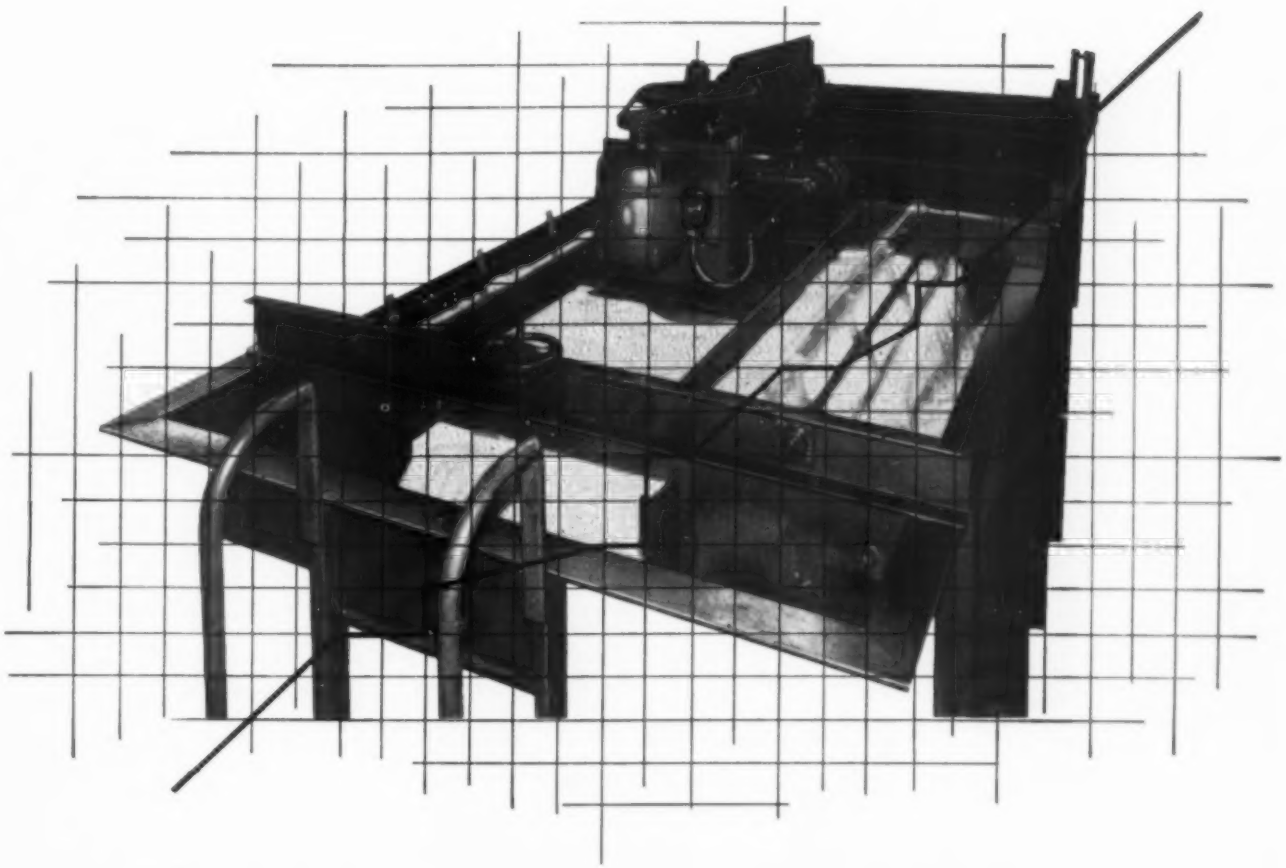
A production line to manufacture the former Mercury line will be set up in Mattison's Blackhawk Avenue plant, which has been recently enlarged. Mattison will employ eight or nine engineers and salesmen from Mercury to help develop the present line of Mattison surface grinders. The move is interpreted as a move by the Rockford firm toward more automated production grinders, which had been the specialty of Mercury's machine tool division.

In announcing the acquisition, Alan C. Mattison, president of the Mattison Machine Works, said, "We have been feeling our way toward automatic production grinding, because it is what the automotive industry is seeking, and here we have it almost ready-made." •

Ex-Cell-O Acquires Two Firms

Ex-Cell-O Corp., Detroit, has announced the acquisition of two new firms, the **Cadillac Gage Co.** of Roseville, Mich., and the **Smith Bearing Co.** of Trenton, N.J. The acquisition was effected by an exchange of stock made December 1, 1956, at which time both companies became wholly-owned subsidiaries of Ex-Cell-O. The two firms will operate as separate units under their existing managements. •

Hoffman engineered systems get **results:**



HOFFMAN CENTRAL FLOTATION SYSTEM

brings sixfold benefits on grinding operations!

With the installation of a central flotation system by Hoffman engineers, the General Railway Signal Company realized the following advantages:

1. Savings of $3,800 in the first year alone by eliminating labor costs for cleaning grinder sump tanks.
2. Thousands more dollars saved by reducing general departmental maintenance.
3. 40% to 50% increase in grinding-wheel life.
4. Greatly extended useful life of coolant, leading to big savings in coolant costs. Coolant was formerly discarded weekly . . . is now clarified and lasts for eight months.
5. Ground parts now have improved surface finish . . . with fewer rejects.
6. Raw materials are economized.

Hoffman equipment can achieve comparable savings and stepped-up production in **your** plant. Why not have Hoffman engineers analyze your specific requirements, without obligation or cost? Write for free bulletin FSP2 and analysis to: —

INDUSTRIAL FILTRATION DIVISION **U.S. HOFFMAN MACHINERY CORPORATION** DEPT. GF, 103 FOURTH AVENUE, NEW YORK 3, N.Y.

INDUSTRIAL FILTRATION DIVISION Machine Tool Coolant Clarifiers—Flotation, Mechanical, and Magnetic. Lubricating and Insulating Oil Conditioners, Filters, and Vaporizers. Solvent Recovery Systems—Vacuum Stills and Filters. **ORDNANCE EQUIPMENT DIVISION** Special Pneumatic Conveying Systems. High Efficiency Centrifugal Separators. Stationary and Portable Vacuum Cleaning Equipment. Process Equipment. Pneumatic Systems for Radioactive Materials. **AIR APPLIANCE DIVISION** Multistage Centrifugal Blowers and Exhausters. Pneumatic Conveying Equipment. Industrial Vacuum Cleaning—Portable and Stationary Systems. Continuous Metal Strip Driers. "Smoothflow" Fittings and Tubing.

Use postpaid card. Circle No. 257

Bendix Aviation and Sheffield to Join Forces

Bendix Aviation Corp. recently announced that it has entered into a contract to acquire the business and assets of the Sheffield Corp., Dayton, O., a privately owned company which is one of the major manufacturers of precision gauging and measurement instruments, and industrial inspection and quality control systems.

The announcement was made concurrently by Malcolm P. Ferguson, Bendix president, and in Dayton by Louis Polk, president of Sheffield, who is this year's retiring president of the National Machine Tool Builders Ass'n.

Ferguson said that to acquire the Sheffield business Bendix will issue approximately 230,000 shares of its common stock. The Sheffield organization will continue to operate under its present management as a wholly owned subsidiary of Bendix.

Sales of Sheffield on an annual basis are currently running approximately $24,000,000 having risen from $1,000,000 sixteen years ago. Sheffield will retain its identity and its product brand names which are well established in its field, it was stated. Polk will become a director, vice president and group executive of Bendix and will continue as president of the Sheffield subsidiary.

Ferguson described the merger of the interests of the two companies as "a logical and promising move in Bendix growth program to help meet the needs of modern industry for more efficient gauging and measurement control systems, and for automation-type equipment." Joining forces with Sheffield he said, will make it possible for a number of promising engineering developments now under way in Bendix divisions to be more effectively marketed. "Also," he said, "we are further broadening the scope of our manufacturing activities which already include more than 350 basic products."

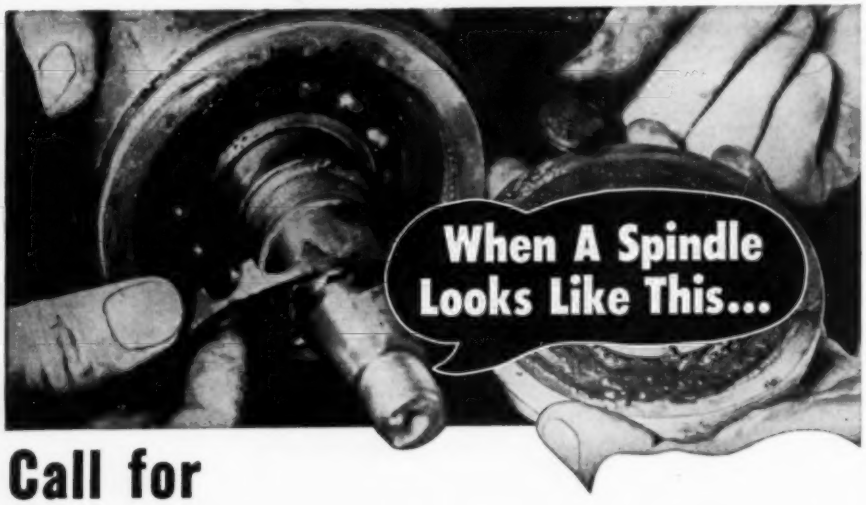
The Sheffield company manufactures a complete line of precision gauging and measurement equipment, including pneumatic gauges, which it pioneered in the 1930's, and is presently pioneering in the development and sale of crushform grinding and ultrasonic machine tools. It has also introduced numerous new units and combinations of precision gauging devices and controls, or "autometrology" systems, enabling industry to achieve automatic gauging, measurement, inspection and quality control in automated production.

Polk explained the move will help Sheffield "to equip our organization with the greatly expanded facilities, engineering, management, production and financial resources we must have in order to meet the largest projected growth opportunities in our history, and to serve our present and potential customers more efficiently."

Sheffield operates plants in Dayton, Cleveland and Fostoria, O.; Greenfield and Conway, Mass.; Mount Clemens, Mich.; Windsor, Canada; and Melbourne, Australia.

Sheffield headquarters, main plant and research laboratories, including its new Eli Whitney Metrology laboratory, will remain in Dayton, Polk said.

The Eli Whitney Laboratory is the first independent industrial facility in the U. S. completely equipped to assist industry in solving basic gauging and dimensional measurement problems to a precision of millionths of an inch. Through the laboratory, Sheffield has expanded its close collaboration with the Bureaus of Standards both of the U. S. and foreign governments in helping to improve precision manufacturing standards and in achieving finer absolute measurement techniques and methods. • •



Call for

Bearings, Inc. Complete

SPINDLE REPAIR SERVICE

All Types and Makes of High Speed Internal and External Grinder Spindles or Quills and Hi-cycle Units . . . Anti-Friction Live Centers

SERVICED OR REBUILT In Hours . . . Not Weeks!

BEARINGS, INC.

3640 EUCLID AVENUE • CLEVELAND 15, OHIO

Branches in OHIO • INDIANA • PENNSYLVANIA
WEST VIRGINIA • NEW JERSEY • KENTUCKY

Gentlemen:

I'd like to have complete information on your spindle repair service.

Name_____

Firm_____

Address_____

City_____ Zone_____ State_____

Use postpaid card. Circle No. 258

Bay State Names Abrasive Engineer to West Coast

John R. Anderson, South Colby, Wash., has been named Bay State abrasive engineer for the entire state of Washington and the northern part of Oregon and Idaho. The appointment was announced by Elden L. Auker, Bay State Abrasive Products Co. sales vice president, Westboro, Massachusetts. •

Michigan Leads Nation in Metalworking Tools Output

Michigan is now the nation's largest producer of metalworking equipment. It is by far the country's largest producer of special dies, tools, and metalworking machinery attachments. It is the second largest producer of machine tools in the United States. However, an analysis of the most recent U. S. Government statistics by Denham & Company, Detroit industrial merchandising agency, shows that Michigan is even threatening to become the nation's number one machine tool producer.

"Michigan now has more plants producing machine tools than any other state in the Union," says Athel F. Denham, agency president. "Its 129 machine tool plants represent a larger total than for New York, New Jersey and Pennsylvania combined. As yet, total value of machine tools produced is still second to Ohio."

In the special die and tools field, Michigan is way out in front, the Denham report says. Almost one-half of the value of all such products produced in the United States originate in Michigan, and almost half the special tool and die workers employed in the United States work in Michigan.

In the production of metalworking attachments, Michigan is also far out in front with about 1/3 of the total payroll and value of attachments produced. Closest is Ohio with less than half of the Michigan total.

Total value of metalworking equipment produced annually in Michigan is well in excess of $3/4 billion, according to the report. •

GM Engineers Outline Fuel Injection Advantages

A detailed story of the new General Motors fuel injection system—Chevrolet's Ramjet—was reported in Detroit at the Society of Automotive Engineers' annual meeting, January 15, 1957.

Speakers were John Dolza, GM Engineering Staff; E. A. Kehoe and Donald Stoltman, Rochester Products Div.; Zora Arkus-Duntov, Chevrolet Motor Div., and John Verkerke, Pontiac Motor Div., which is adapting the system to its Bonneville sports convertible.

Discussing GM Engineering Staff's basic development of the system, Dolza said that "a fuel system capable of correcting even 50 per cent of average carburetor deficiencies may produce a 10 per cent improvement in fuel economy that would ultimately result in a substantial savings to the customer." He described the GM development as "our own system," produced after a thorough study of various other systems—Diesel, aircraft and automotive.

Arkus-Duntov said the new system, replacing conventional carburetors on both the high-performance Corvette and conventional passenger cars, resulted in "superior performance, reduced fuel consumption and instantaneous response to the throttle at all speeds and loads. . . . "

"Chevrolet became actively interested in the GM fuel injection system primarily for the Corvette sports car, in order to realize the full potential of the engine for high performance," Arkus-Duntov said.

Kehoe and Stoltman detailed the design and production developments at Rochester Products Div., manufacturer of the system.

They said the need for fuel injection is established and to the engineer "The door is open to a new potential of advancements not possible with the conventional carburetor." •

Sheffield Establishes Windsor Gage, Tool Plant to Meet Needs of Canadian Industries

The Sheffield Corp., Dayton, O., developers and manufacturers of gaging and measurement devices and systems and special precision production machines, has established a Canadian manufacturing and service plant in Windsor, Ont.

Services available to Canadian manufacturers direct from the Windsor plant will include repair and rework of Sheffield gage tooling and spindles, design and manufacture of special fixture gages; manufacture of high speed steel cutting tools, including taps; regrinding of broaches and cutting tools; manufacture of plain cylindrical plug and ring gages and ring type setting masters for Sheffield Precisionaire gages. •

Production Grind - Tungsten Carbide - Steel - Stainless Glass - Plastic or Carbon to .0002 or 6 to 8 Micro finish *

on the ROYAL MASTER TG-12 Centerless Grinder

Apply the versatile Royal Master TG-12 to your grinding problem. It will finish grind from .004 to 1 ½ inches in diameter.

It may be used for either plunge or thrufeed grinding with conversion to either a matter of minutes.

It may be put to work **without** prior spindle warm up time with unparalled accuracy and dependibility - (Based on machines in use for 5 years.)

Low depreciation based on inital cost - Ease and speed of set up time due to accessibility of work zone - Rapid replacement of work wheel and packaged hydraulic system for automatic cycling, are other features of the TG-12. What are your requirements?

* **May we demonstrate the TG-12 for you on your parts?**

Also Grinds Wood, Non-ferrous Metals, Fibre, Hard Rubber, Cork, etc.

☐ Please contact me regarding my "centerless grinding" requirements.

☐ Please forward literature describing the TG-12.

PERS. ..... TITLE .....

FIRM .....

STREET .....

CITY ..... STATE .....

ROYAL MASTER INC.

200 State Highway 23, Riverdale, New Jersey

Use postpaid card. Circle No. 259

Billion Dollars to Speed Office Techniques Seen

During the next three years U. S. business will spend a minimum of $1 billion to modernize office procedures to keep pace with our fast growing economy, in the opinion of a leading electronics official.

Walter W. Finke, president of Datamatic Corp., today estimated that there are currently at least one thousand firms—industrial, business, financial, service and government agencies—that are "losing money every day they struggle to stem the mountainous tide of paperwork with obsolete equipment and clerical, billing and bookkeeping procedures that are fast becoming outdated." With a $500 billion economy predicted for 1960, Finke said, there is no prospect of a diminishing of this paperwork load.

In a year-end forecast Finke indicated that this business climate would stimulate sales of electronic computer systems — generally regarded as one practical answer to these problems. He estimates that the $1 billion to be invested in office automation before 1960 actually represents about 50 per cent of the current market for large-scale ($1.5 million to $2 million) general-purpose electronic data-processing systems. •

New Patent Service

A new product clearing house which arranges contacts between American and foreign manufacturers has been established by the International Patent Exchange, Elmhurst, Ill. The service is designed to curb difficulties encountered in exploring licensing or partnership arrangements, according to Richard Vrablik, president.

In operation, to license patent rights to foreign firms, an American manufacturer submits his patents, techniques or product data to the IPE. To lease a foreign patent, the domestic firm submits his facilities and type of product desired. IPE then develops an appropriate manufacturer's interest, receiving a percentage of royalties for its services. IPE's study of the domestic and foreign manufacturing market shows a definite interest in product diversification to meet increased competition.

"This service will prove a valuable adjunct to international commerce," Vrablik said. "Products obtained in this manner have passed the test of production, distribution, pricing, and acceptance. While income derived from leasing patents is comparatively effortless in that it eliminates capital and management participation."

International Patent Exchange, Dept. 71, 594 Edgewood Ave., Elmhurst, Ill. •

Electro Refractories Director Aids in Guidance Program

George J. Easter, research director of Electro Refractories & Abrasives Corp., has added a fourth Buffalo school to the list of those he serves in connection with the student guidance program sponsored by Massachusetts Institute of Technology. His enlarged schedule now will include Orchard Park High School as well.

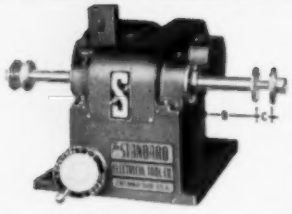
The program is aimed at helping those students interested in scientific careers. Easter and other prominent M.I.T. alumni give talks and advice on various aspects of science. •

Borg-Warner Executive Appointments

The election of **Henry M. Haase,** vice-president in charge of engineering and research for Borg-Warner, as president and chief executive officer of the York Div. of Borg-Warner Corp. at York, Pa., has been announced. Haase will continue to be a vice-president of Borg-Warner but in the future will not direct the parent corporation's research and engineering activities.

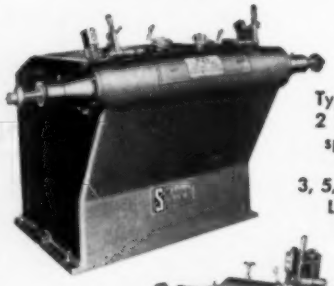
Simultaneously the elevation of **Stewart E. Lauer** to the chairmanship of the board of the York Div. was announced. Lauer had been president of York for 16 years. The chairmanship of York has been relinquished to Lauer by **Roy C. Ingersoll,** who has borne that title in addition to his responsibilities as chairman of the board of Borg-Warner since York Corp. was merged with Borg-Warner in July, 1956. •

FOR FINISHING TO A "STANDARD"



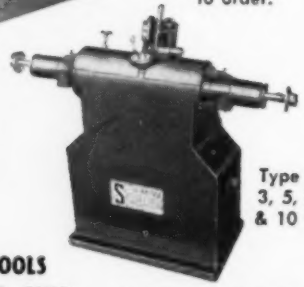
BVB 1 HP
Bench Model

Standard Buffers and Polishers are superbly engineered for top production. "Speedial" control lets you choose speed between 1500 and 3000 RPM *instantly*. Buffing, polishing, coloring to a uniform finish by maintenance of constant peripheral speed.



Type R2V with 2 independent spindles and motors. 3, 5, 7½ & 10 HP. Larger sizes to order.

HALLMARK OF METALWORKING THROUGHOUT THE WORLD



Type RV 3, 5, 7½ & 10 HP.

the STANDARD electrical tool co.

BUFFERS - POLISHERS and MACHINE TOOLS

2478 RIVER ROAD • CINCINNATI 4, OHIO

WRITE FOR CATALOGUE

INFINITELY VARIABLE SPEED, PROPER SPEED, MOTOR DRIVEN

BUFFERS — POLISHERS

Use postpaid card. Circle No. 260

Minnesota Mining Distributors to Handle Barrel Equipment

Distributors of Minnesota Mining "Honite" brand barrel finishing materials have added the lines of four major barrel equipment manufacturers. The 3M company said it is coordinating its distributor expansion in an effort to help other manufacturers market advanced barrel finishing equipment, and that new lines and products would be included as they are field-proved.

Twenty-two 3M distributors located in major metalworking centers across the country will handle, in addition to their "Honite" brand products, equipment made by:

Speed-D-Burr Corp., Glendale, Calif., makers of the Mitey-Mite line of barrel finishing equipment.

Metal Finish Inc., Newark, N.J., makers of an established east coast equipment line now being marketed nationally for the first time.

Rampe Manufacturing Co., Cleveland, O., makers of low-cost, precision-built, small capacity equipment.

Crown Rheostat and Supply Co., Chicago, first builders of modern barrel finishing equipment for the application of abrasive chips to barrel finishing. •

Major Wheel Plant for Carborundum in Ohio

The Carborundum Co. will build a new multi-million dollar plant in Van Wert, O. for the manufacture of high volume, small abrasive wheels, according to an announcement by Clinton F. Robinson, president of the firm in Niagara Falls, N.Y. The new plant is part of Carborundum's $30,000,000 modernization and expansion program scheduled for 1957 and '58.

At the Van Wert plant the Bonded Abrasives Div. will manufacture small vitrified abrasive wheels up to 14 inches in diameter, sold in large volume, that are adapted to automatic production methods. The plant, approximately 3 years in the engineering and designing stage, will provide for many automatic processes, with orderly flow of materials from abrasive mix, through molding, firing, finishing, testing, and shipping.

The single ground floor structure to be built by Brown & Matthews, general contractors of New York City, will be 440 ft. x 160 ft., with one side extension for a battery of kilns and another extension for offices, and will encompass a total of 91,000 sq. ft. of floor space.

The building is scheduled for completion in late 1957 and for full operation by the end of 1958. •

Crane Packing Co. Facilities Throughout U.S. and Canada

Crane Packing Co., producer of mechanical seals and packings, Chemlon products, precision lapping machines and pipe joint and thread compounds, has just completed a 6-year expansion and construction program. The program started in 1951 with the breaking of ground for the recently completed home offices, laboratory and factory located on a 22-acre tract in the Chicago suburb of Morton Grove, Ill.

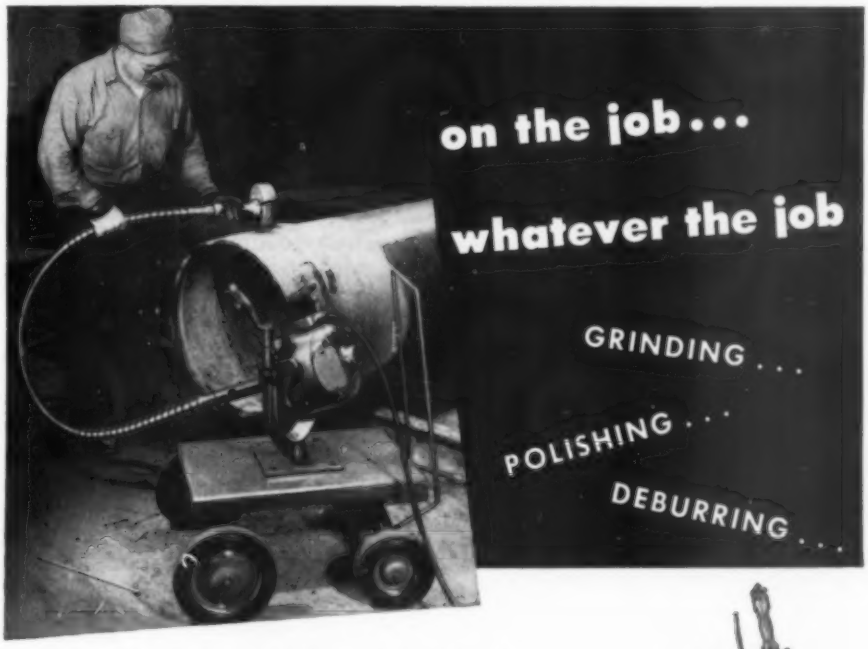
Construction encompassed erection of four new plants and expansion of a fifth. First plant completed was at Houston, Texas, serving the oil producing territories. This was followed by new home facilities in the Chicago area, a Los Angeles plant, and another in Hackensack, N. J. Expanded offices and factory at Hamilton, Ont., give access to Canadian markets. •

New Detroit Address for Landis Machine

Landis Machine Co. of Waynesboro, Penn., has announced the relocation of its Detroit office to 12806 Fenkell Ave., Detroit 27. •

Anocut Appoints 3 Service Engineers in Expansion Program

Anocut Engineering Co., Chicago manufacturer of electronic power control units for electrolytic grinding, has announced the appointment of three service engineers. Anocut's Michigan and Northwestern Ohio territory will be serviced by **William R. Allen** of St. Clair Shores, Mich. For Northeastern Ohio, Western Pennsylvania and Western New York, Anocut has named **Thomas Tomezak** of Lakewood, **O. Lee Johnson**, of Chicago, will be service engineer for the midwest region. •



Whether you're grinding, polishing, deburring—or a vast number of other metalworking operations—you can be sure that Strand flexible shaft machines will handle the work easily and effectively in a minimum amount of time and with minimum operating expense.

For portability and operating convenience, Strand machines are what you need. They can be taken to—and operated in—virtually any spot in your plant. And only the lightweight handpiece is held by the operator, *not a heavy motor.*

The Strand bench, floor and vertical models are available from ¼ to 3 horsepower with yoke mounts that enable the motor to adjust itself. Find out about the productive Strand flexible shaft machines now.

Write for a Catalog and the Name of Your Nearest Strand Dealer Today!

N. A. STRAND Flexible Shaft, Inc.

5855 W. Lawrence Avenue • Chicago, Illinois

Use postpaid card. Circle No. 261

Walter E. Foreman now Norton Abrasive Engineer

Walter E. Foreman has been appointed an abrasive engineer by Norton Co. He will make his headquarters in Columbus, O., and cover the southeastern Ohio area. Foreman has been with Norton since 1945 and was a member of the sales engineering department until 1949 when he was appointed a field engineer at the Cleveland District office, a post he has held until now. Prior to joining the company, he had 18 years' experience in steel and cast iron foundries. •

Harrison Elected Treasurer of Snyder Tool & Engineering Co.

S. David Harrison has been elected treasurer of Snyder Tool & Engineering Co., Detroit manufacturer of special machine tools and automated transfer machines for the metalworking industry as well as filling machines and tabletting equipment for the pharmaceutical and chemical industries. •

Mustard Ex-Cell-O Sales Mgr.

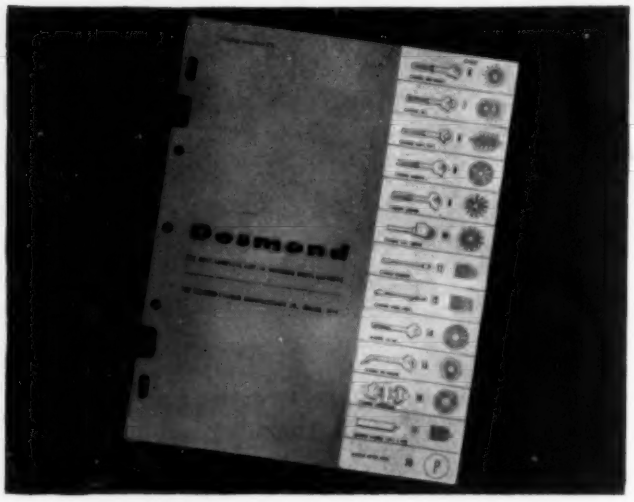
The appointment of **Jack L. Mustard** as sales manager, Industrial Div., has been announced by D. H. McIver, vice president, Industrial Sales, Ex-Cell-O Corp., Detroit. He will continue working with Ex-Cell-O's industrial repre

sentatives, both in the Detroit area and in the national sales organization. •

Electro Refractories Award

David C. Hill has been awarded the Electro Refractories & Abrasives Corp. undergraduate fellowship at Alfred University. A ceramics course senior, Mr. Hill will work on the problem of rapid testing of feldspar under the guidance of Assistant Prof. Richard West. •

DRESS RIGHT



More pieces ground per hour, more pieces per wheel . . . yours if you dress your grinding wheels regularly. Desmond dresser catalog free on request.

The only complete line of grinding wheel dressers and cutters

Desmond

THE DESMOND-STEPHAN MFG. CO., URBANA, OHIO

Use postpaid card. Circle No. 262

LEA GRIPMASTER®

Industry's Abrasive { BONDING CEMENT for Wheels and Belts

SIZES AS WELL AS BONDS

Gripmaster cuts out one preparation material and one preparation step. No special sizing is necessary. This superior bonding cement has a double use. But seein' is believin'. Test Gripmaster in your own plant under your own working conditions. Send us the enclosed coupon or use your company stationery and we'll send you a test size sample *without charge or obligation.*

LEA-MICHIGAN, INC.

14066 Stansbury Ave., Detroit 27, Michigan

(A member of the well-known Lea Group of Finishing Specialists)

Lea-Michigan, Inc.
14066 Stansbury Ave.
Detroit 27, Mich.

☐ Please send us your free sample of GRIPMASTER.
☐ Please send us literature giving full details.

Name _____ Title _____

Company _____

Address _____ G. & F. 2.57

Use postpaid card. Circle No. 263

Kaydon Appointments

The Kaydon Engineering Corp. has announced the appointment of **Robert L. Blais** as assistant sales manager of Special Bearings succeeding **Robert A. Weisse,** who has been made sales manager of a new division to handle the Kaydon Size-O-Tron.

R. L. Blais

R. A. Weisse

Blais was graduated by the University of Notre Dame in 1950 with a B.S. in Mechanical Engineering and joined Kaydon in 1951 working in the engineering department, then moved to the position of sales engineer.

Weisse joined Kaydon in the engineering dept. in March 1951 and after serving as a sales engineer, was appointed assistant sales manager nine months later. •

Higher Price For Diamond Swarf

Norton Company has announced an increase of approximately 10% in the allowance it will pay for diamonds reclaimed from grinding swarf and diamond wheel stubs returned for salvage by customers. Under the present table of allowances, the company will pay up to $2.00 per carat for diamond reclaimed.

Many users of diamond grinding wheels have found reclaiming swarf and wheel stubs a practical means of substantially reducing their grinding costs.

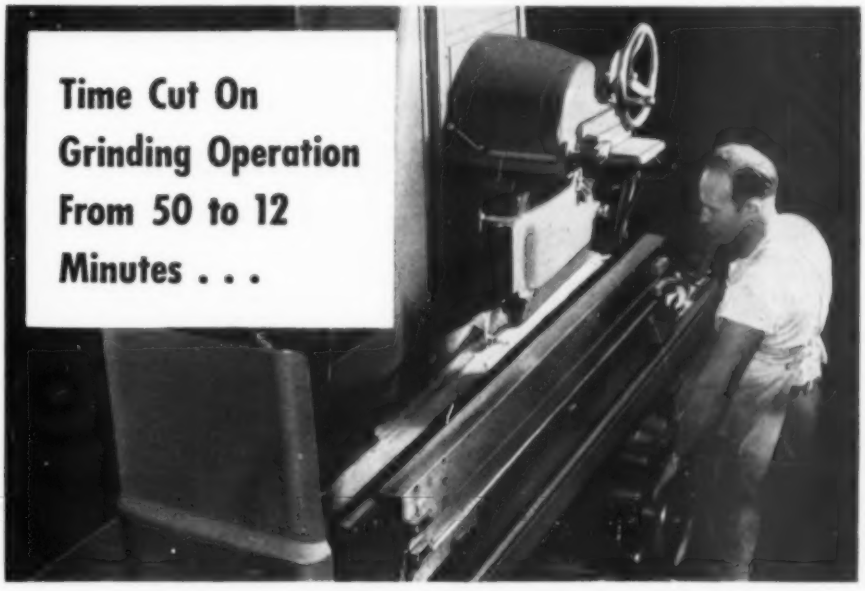
Norton Co., Worcester 6, Mass. •

Diaz Named President of Wesson Tool Company

The election of **Manuel F. Diaz** as president of Wesson Tool Co., Ferndale, Mich., has been announced by W. B. Duncan, chairman of the board. Diaz replaces Ernest Mortensen, who recently retired after fifty years in the cutting tool industry.

Other Wesson promotions include that of **Nicholas Jacoby** to general superintendent; **Ernest Reinhardt** to general mill foreman; and **George Knable** to general night foreman.

Diaz, who joined Wesson Tool Company in 1937, was elected assistant secretary-treasurer in 1940 and a year later was named vice-president. Following reorganization of the Wesson group of six companies in 1946, he was elected to the position of secretary-treasurer and a director of all Wesson subsidiary companies located in Ferndale and Brighton, Mich.; Lexington, Ky.; and Toronto, Ont., Canada, the Canadian division being the most recently created subsidiary. He continues as a director of these companies.



With SUNDSTRAND "POWER-GRIP" Magnetic Chucks

Here's another good example of time savings with Sundstrand Magnetic Chucks. Two airplane flap tracks are held at one time for grinding on opposite faces of rail. Grinding stroke is 70 inches. Former time with conventional holding equipment was 50 minutes. With change to Sundstrand "Power-Grip" Chucks time is cut to 12 minutes . . . a savings of 38 minutes per part.

There's a good chance that you may be able to save considerable time in milling or grinding operations with Sundstrand "Power-Grip" Magnetic Chucks. Call in a Sundstrand Engineer. There is no obligation for this service.

Free Data is available on Sundstrand Clamping fixtures. Write today. Ask for bulletin 469-M

SUNDSTRAND POWER-GRIP ®

SUNDSTRAND Magnetic Products Co.

Division of Sundstrand Machine Tool Co.
1020-9th ST. • ROCKFORD, ILLINOIS

Use postpaid card. Circle No. 264

Mayl Retires at Goodyear

Retirement of **Joseph E. Mayl,** vice-president, general products group, Goodyear Tire & Rubber Co., as of Jan. 31, was announced by E. J. Thomas, president.

Joseph E. Mayl

Sam DuPree, general manager of Goodyear's Industrial Products Div., will succeed Mayl. DuPree will be responsible for coordinating activities of the company's Industrial Products,

Sam DuPree

Aviation Products, Metal Products, Shoe Products, Foam Products, Films and Flooring Divisions, and the Government Sales department. •

Behr-Manning Promotes Durnan to Regional Post

Behr-Manning Co. of Troy, N. Y., a division of the Norton Co., has advanced **John J. Durnan** to the post of

John J. Durnan

eastern regional product engineer to succeed Elmo Oathout, who retired recently.

Durnan is a veteran of 14 years with Behr-Manning. He served for three years as foreman of the grinding department in the company's mechanical division, and has since been a product engineer based at Troy. He is a member of Mohawk Chapter, American Society of Tool Engineers. •

SOMETHING NEW HAS BEEN ADDED:

The Vonnegut 32 brush polishing head is now available in *one* inch abrasive face width to get inside the most intricate metal or wood patterns! Your choice of either short or long-trim bristles for 32, 16 and 12 brush models. New design fits shorter spindles! Get the full story of this versatile tool—a "must" in every metal and wood working shop! Write for Bulletin No. 102.

Makers of the famous MARSCHKE grinders and buffers.

Grinding and Polishing Machinery Corp.
SUCCESSORS TO VONNEGUT MOULDER CORPORATION
2530-B WINTHROP AVENUE, INDIANAPOLIS 5, INDIANA
Use postpaid card. Circle No. 265

GRINDING and FINISHING'S READER'S SERVICE CAN HELP YOU...

—increase your profits;
—increase your production;
—increase your quality;
—lower your costs;

by keeping you informed about NEW PRODUCTS, MATERIALS & PROCESSES!

WHATEVER YOU NEED TO SOLVE SPECIFIC PROBLEMS,

. . . information about a particular subject, products, materials or processes;
. . . additional copies, articles or reprints;
. . . a solution to a shop problem;
. . . technical booklets or information;
. . . literature from a specific manufacturer;
. . . manufacturers of a certain type of equipment or supplies,

WRITE and/or RETURN THE POSTAGE-FREE ACTION CARD YOU'LL FIND IN EACH ISSUE OF GRINDING and FINISHING

It's a HITCHCOCK PUBLICATION. . .
Most thoroughly SERVING YOUR INDUSTRY!

hitchcock publishing company
222 e. willow avenue • wheaton, illinois

Stine Elected President of Pangborn Corporation

Victor F. Stine has been elected by the stockholders, as of January 1, 1957, to serve as the new president of Pangborn Corp., Hagerstown, Md., manufacturers of blast cleaning and dust control equipment. Concurrent with Stine's appointment, **Ralph M. Trent** assumes the duties of a director and executive vice-president and **W. O. Vedder** was elected a vice-president. **Thomas W. Pangborn,** founder and president of the corporation since 1904, will continue to serve Pangborn as chairman of the board of directors, while **John C. Pangborn,** former 1st vice-president will fill the office of vice-chairman of the board. •

Western New York Distributor for Electro Refractories & Abrasives

The Enos & Sanderson Co. has been appointed distributor for western New York by Electro Refractories & Abrasives Corp. A well known steel and industrial supplier, the Enos & Sanderson Co. was formed 61 years ago to engage in the business of carriage maker, blacksmith, hardware and steel supplies. •

SACRIFICE CASTING GRINDERS

We have lost our lease and must immediately dispose of the following:

2—Besley Double End Disc Grinders, model No. 214, 26" wheels, 25 H.P. motors, equipped with right and left hand grd. lever-feed tables, cost new $2500.00

2—Bridgeport High Speed Grinders, Dble. End floor type, model No. 161—10 H.P., cost new $1850.00

These machines were purchased new by us, and have seen less than 30 days actual service.

Also—1 Besley Double End Disc Grinder, model No. 208, wet type, no motor—6 months use. Cost new $1800.00.

NO REASONABLE OFFER REFUSED ON THESE MACHINES

STAFFORD MANUFACTURING CO., INC.
145 - 58th Street Brooklyn, New York
HY 2-6000

Jandron to West Coast

Roland L. Jandron has been appointed a field engineer at Norton Company's Los Angeles district office effective January 1, 1957. For the past year, he has held a similar post in Chicago. •

Anocut Names Three New Dealers

Anocut Engineering Company, Chicago, manufacturers of equipment for electrolytic grinding, announces the appointment of the following three dealers to its growing Eastern distributor roster: The Oatis Machinery Company, Indianapolis and Toledo, Garco Machinery, Inc., Cleveland, and William K. Stamets Company, Pittsburgh. •

OPENINGS IN TECHNICAL SALES

Recent college graduates in engineering, business administration or liberal arts: or

Men with 3-5 years general experience in production or technical sales: or Men with longer experience in the application of abrasive products to tool or production engineering:

Leading and expanding company offers promising opportunities in grinding wheel sales. Comprehensive training provided at main plant in Worcester, Massachusetts, before assignment to field location, or headquarters sales engineering.

Positions also open in Refractories and Grinding Machine Sales Engineering.

Send resume to R. W. Cornish
Sales Training Supervisor

NORTON

NORTON COMPANY

13 New Bond St. Worcester 6, Mass.
Abrasives - Refractories - Grinding Machines

PRESSURE LOK® - 224

RESINOID DIAMOND WHEELS

— the best diamond wheel bond ever developed—
if you've used them - you know they're best!
if you haven't - let us show you!

UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.

Use postpaid card. Circle No. 266

Grinding & Finishing

helps you;

—increase PROFITS
—increase PRODUCTION
—increase QUALITY
—lower COSTS

by keeping you informed about

New Products, Materials and Processes!

Every month, after you've read GRINDING and FINISHING and you want additional information on any of the articles or ads, MERELY INDICATE THE ITEMS OF INTEREST, TEAR OUT and MAIL YOUR POSTAGE-PAID INFORMATION REPLY CARD.

Whatever you need:

—information about a particular subject, products, materials or processes;
—additional copies, articles or reprints;
—a solution to shop problems;
—technical booklets or information;
—literature from a specific manufacturer, or
—manufacturers of a certain type of equipment or supplies,

DURING 1956, GRINDING and FINISHING'S READER SERVICE made thousands and thousands of contacts with advertisers, requesting information for readers—sent thousands of reprints and booklets, and wrote thousands of letters . . . all to help readers solve their specific problems.

take advantage of grinding and finishing's reader service

it will help you!

a hitchcock publication 222 E. Willow Avenue, Wheaton, Illinois

GRINDING and FINISHING

DISTRICT MANAGERS

EASTERN DIVISION

Dan E. Reardon, V.P.
Box No. 1, South Glastonbury, Conn.
Telephone: MEdford 3-7083
or
c/o Hitchcock Publishing Co.
55 West 42nd Street
New York 36, N.Y.
Telephone: LAckawanna 4-4528

NEW ENGLAND—CONN., MASS., R.I., ME., N.H. & VT.

John Pickering, Jr.
592 Osgood St.
North Andover, Massachusetts
Telephone: MUrdock 8-0913

EASTERN PENNA., EASTERN N.Y. STATE, N.J., MD., DELA., D. of C

H. George Burnley
c/o Hitchcock Publishing Co.
55 West 42nd Street
New York 36, N.Y.
Telephone: LAckawanna 4-4528
Home Address: Saddle River, N.J.
Telephone: DAvis 7-1546

CENTRAL DIVISION

SOUTHWESTERN OHIO, INDIANA, KENTUCKY

Henry J. Smith, V.P.
c/o Hitchcock Publishing Co.
222 East Willow Avenue
Wheaton, Illinois
Telephone: WHeaton 8-3400

MICHIGAN, NORTHERN IND., NORTHWESTERN OHIO.

William E. Jacobs
c/o Hitchcock Publishing Co.
18055 James Couzens Highway
Detroit 35, Michigan
Telephone: DIamond 1-9525

ILLINOIS, IOWA, MO., WISC., MINN., UPPER PENINSULA of MICH., and S. DAKOTA

Robert G. Bolinder
c/o Hitchcock Publishing Co.
222 East Willow Avenue
Wheaton, Illinois
Telephone: WHeaton 8-3400

WESTERN NEW YORK STATE, WESTERN PENNA., OHIO

Ralph E. Helfrick
1507 Edgefield Road
Cleveland 24, Ohio
Telephone: HIllcrest 2-0189

WESTERN DIVISION

CALIFORNIA, ARIZONA

Keith H. Evans
3723 Wilshire Boulevard
Los Angeles 5, California
Telephone: DUnkirk 8-2981
and: 593 Market St. (Room 816)
San Francisco 5, Calif.
Telephone: YUkon 2-4280

OREGON, WASHINGTON

Lloyd Thorpe
6133 Arcade Building
Seattle 1, Washington
Telephone: MUtual 7525

HITCHCOCK PUBLISHING CO.

Telephone WHeaton 8-3400

Wheaton, Illinois

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B&S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

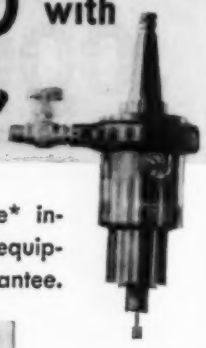
K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

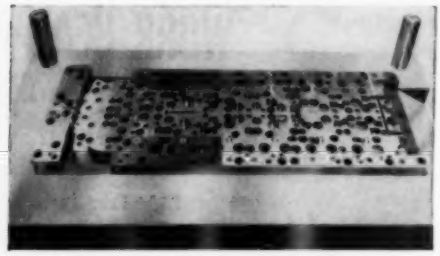
Use postpaid card. Circle No. 267

Holes

JIG GROUND with *Vulcanaire*



Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

Borrow our instructive 11 minute movie on Jig Grinding.

A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

743 LORAIN AVE. DAYTON 10, OHIO

Use postpaid card. Circle No. 267

Index to Advertisers and Products

(With a List of Their Advertising Agencies)

Abrasive Machine Tool Company (Grinding Machines) 20
Creamer-Trowbridge Company
Aget Manufacturing Company (Dust Collectors) 56
Slayton-Racine, Inc.
American Emery Wheel Company (Grinding Wheels) 61
Horton, Church & Goff Inc.
American Herforder Corporation (Universal Grinders)..... 80
F. E. Anderson Oil Company (Coolants & Lubricants) 16
Peck-Adams Inc.
Arter Grinding Machine Company (Grinding Machines) 76
John W. Odlin Company, Inc.
Barnes Drill Company (Honing Tools) 96
Wendell C. Galloway, Industrial Adv.
Bay State Abrasive Products Company (Grinding Wheels) .....4th Cover
Berg-Marshall Inc.
Bearings, Incorporated (Spindle Repair Service) 84
Brad Wright Smith Advertising Inc.
Besly-Welles Corporation (Grinding Machines, Abrasive Products) 17-19
Stoetzel & Associates
Bryant Chucking Grinder Company (Grinding Machines)....4, 5
Henry A. Loudon Advertising, Inc.
Chicago Wheel & Manufacturing Company (Mounted Wheels) 53
Frank C. Nahser Inc.
Cincinnati Milling Machine Company (Grinding Machines) 2, 3
Jaap-Orr Advertising Agency
Cincinnati Milling Machine Company, Grinding Wheels Division (Grinding Wheels) 41
The Ralph H. Jones Company
Cleveland Instrument Company (Electronic Production Gages) 58
Ralph M. French Adv.
Cortland Grinding Wheel Company (Grinding Wheels) 59
William B. Remington, Inc.
Crane Packing Company (Tapping Machines) 62
Cratex Manufacturing Company (Rubberized Abrasives).... 54
West-Marquis, Inc.
Crystal Lake Grinders (Grinding Machines) 95
Desmond-Stephan Manufacturing Company (Wheel Dressers & Cutters) 88
Odiorne Industrial Advertising
Di-Met Corporation (Carbide Finishing Machines) 63
Clyde D. Graham Advertising
DoAll Corporation (Grinding Coolants) 51
Russell T. Gray, Incorporated
Dumore Company (Tool Post Grinders) 68
Stoetzel & Associates
Exolon Company, Incorporated (Tumbling Abrasives) 21
Melvin F. Hall Advertising Inc.
Globe Trading Company (Work Rests) 50
Grinding & Polishing Machinery Corporation (Brush Polishing Heads) 90
G. A. Saas and Company
Hammond Machinery Builders, Incorporated (Double Spindle Lathes) 71
Stevens, Inc.
Hanchett Manufacturing Company (Metal Saw Sharpeners) 48
The Jaqua Company
Harig Manufacturing Company (Grinding & Fixtures) 64
Conner Associates
Heald Machine Company (Boring Heads & Wheel Heads) .....2nd Cover
Marstellar, Rickard, Gebhardt & Reed, Inc.
Hill-Acme Corporation (Surface Grinders) 22
Osborn Bartlett & Associates
International Chemical Company (Grinding Coolants) 77
Renner, Incorporated
International Refining & Manufacturing Company (Coolant & Grinding Compounds) 78
J & S Tool Company, Inc. (Down Holding Devices and Wheel Dressers) 12
Gordon A. Pihl & Associates
Kuzmick Company, The Paul L. (Diamond Wheels) 72

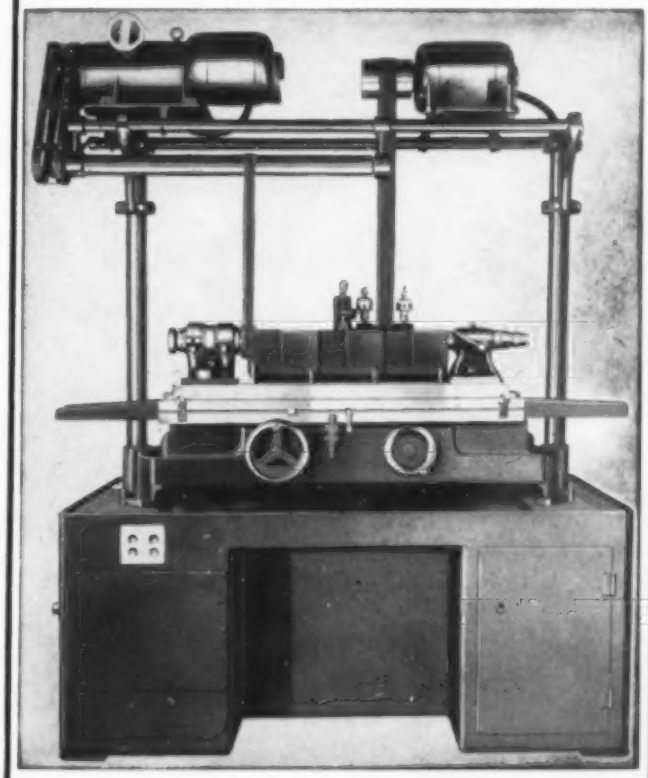
Lassy Tool Company (Angle Plates) 54
The Walker Rackliff Co., Advertising
Lea-Michigan, Incorporated (Abrasive Bondings & Cement) 88
Sanger-Funnell, Incorporated
Lee, K. O. Company (Motor Driven Work Heads) 93
Acme Advertising Agency
Macklin Company (Grinding Wheels) 47
Rumsey & Associates
McDonough Manufacturing Company (Tilting Spindles).... 52
Keystone Advertising, Inc.
Merit Products, Incorporated (Flexible Grinding Wheels).... 60
Byron H. Brown & Staff
Micromatic Hone Corporation (Honing Tools & Machines) .....74 & 75
Gray & Kilgore, Inc.
Micrometrical Manufacturing Company (Profilometers) 56
Carl Connable Advertising
Minnesota Mining and Manufacturing Company (Abrasive Belts) 13
Batten, Barton, Durstine & Osborn, Inc.
Moore Special Tool Company, Inc. (Jig Borers & Grinders) 70
Fred Wittner Advertising
National Broach & Machine Company (Gear Honing Machines) 45
Witte & Burden Advertising
Norton Company, The, Abrasive Grains Division (Abrasive Spheres) 16A
James Thomas Chirurg Company
Norton Company, The, Abrasive Grinding Wheels Division (Grinding Wheels) .....16B & C
James Thomas Chirurg Company
Parker-Majestic, Incorporated (Spindles) 16D
L. E. Mitchell Agency
Pope Machinery Corporation (Spindles) 46
Walter B. Snow & Staff, Inc.
Precise Products, Incorporated (Power Quills) 50
Thomas J. Hubert Advertising
Production Machine Company (Grinding Machines) 81
Charles Palm Company
Rivett Lathe & Grinder, Incorporated (Grinding Machines).... 55
Paul A. Fergus Company
Rocheleau Tool & Die Company, L. A. (Cutter Grinder Fixtures) 79
Berg-Marshall, Inc.
Roto-Finish Company (Barrel Finishing) 65
The Jaqua Company
Royal Master, Inc. (Grinding Machines) 85
Vonderhorst & Champy, Incorporated
Simonds Abrasive Company (Grinding Wheels) 6-9
Fox & Mackenzie Advertising
Sopko & Sons, Incorporated, William (Grinding Wheel Adapters) 34
Stedfeld & Byrne, Inc.
Speed-D-Burr Corporation (Barrel Finishing Equipment).... 73
Harry G. Willis & Associates
Spitfire Tool Company (Tapping Machines) 44
Leonard Advertising
Standard Electrical Tool Company (Buffing & Polishing) 86
Dinerman & Company, Inc.
Sterling Grinding Wheel Co. (Grinding Wheels) .....3rd Cover
Central Advertising Agency
Strand, N. A., Flexible Shaft, Inc. (Flexible Shaft Machinery) 87
Lester L. Jacobs, Inc.
Stuart Oil Company, Ltd., D. A. (Liquid Cutting Compounds) 14, 15
Howard H. Monk & Associates, Inc.
Sundstrand Magnetic Products Company (Magnetic Chucks) 89
Howard H. Monk & Associates, Inc.
Sunnen Products Company (Honing Machines) 49
H. George Bloch Advertising Inc.
Taft-Peirce Manufacturing Company (Magnetic Chucks) 42, 43
Sutherland-Abbott
U. S. Diamond Wheel Company (Diamond Wheels) 91
Kenneth B. Butler & Associates
U. S. Hoffman Machinery Company (Flotation Systems) 83
Mohr Associates, Inc.
Van Norman Machine Company (Centerless Grinders) 10, 11
Sutherland-Abbott
Vulcan Tool Company (Jig Grinders) 94
Chester C. Moreland Company
Walls Sales Corporation (Belt Sanders) 52
Powerad Company Advertising

HOW CAN YOU LOSE WHEN YOU USE CRYSTAL LAKE GRINDERS

EASY OPERATION: CLOSE TOLERANCES: ACCURACY: FINE MICROINCH SURFACE FINISH

A CRYSTAL LAKE GRINDER will hold size as well as grind round from .000005 to .000020" and finish from One to Four Microinch SURFACE FINISH. The essentials in grinding are a round spindle, taper bearings, a spindle that can be adjusted periodically without the squashing of bronze boxes and to have belt pressure ninety degrees from grinding pressure so the bronze boxes will not wear out of round.

For example, fuel injectors, after having been rough ground, can be ground to .000010" roundness with a sixty grit wheel and one pass of the wheel.



A choice of General Electric Thymotrol, General Radio Variac, or Variable Speed Drive can be used without ripple or cine' wave being transmitted to work as all motors are mounted on self-contained countershaft.

Write for literature

CRYSTAL LAKE GRINDERS

Since 1910

CRYSTAL LAKE, ILLINOIS

Use postpaid card. Circle No. 268

NEW DESIGN in HONING TOOLS provides

few parts

quick-loading

simple construction

low tool maintenance

easy stone-replacement

improved wear characteristics

greater abrasive support

for bores up to 4"

This new Barnesdril Honing Tool design means more efficient honing operations because it supplies better abrasive wear characteristics and greater strength at the point of cutting. The tool has very few parts in its simple construction, and may be designed for use with either a floating or rigid fixture. Barnesdril wing-type abrasive stones are press-fit between standard hardened inserts which act as side supports for the stones as well as guides in the bore. Fiber jackets reduce stone wear by protecting the inserts against the abrasive and serve to hold the wing-type stones firmly in place.

Fully protected by patents, this new honing tool will improve your honing operations and reduce honing tool costs on honing operations. See your Barnesdril representative, or send us prints of your honing operations for recommendation.

50th year

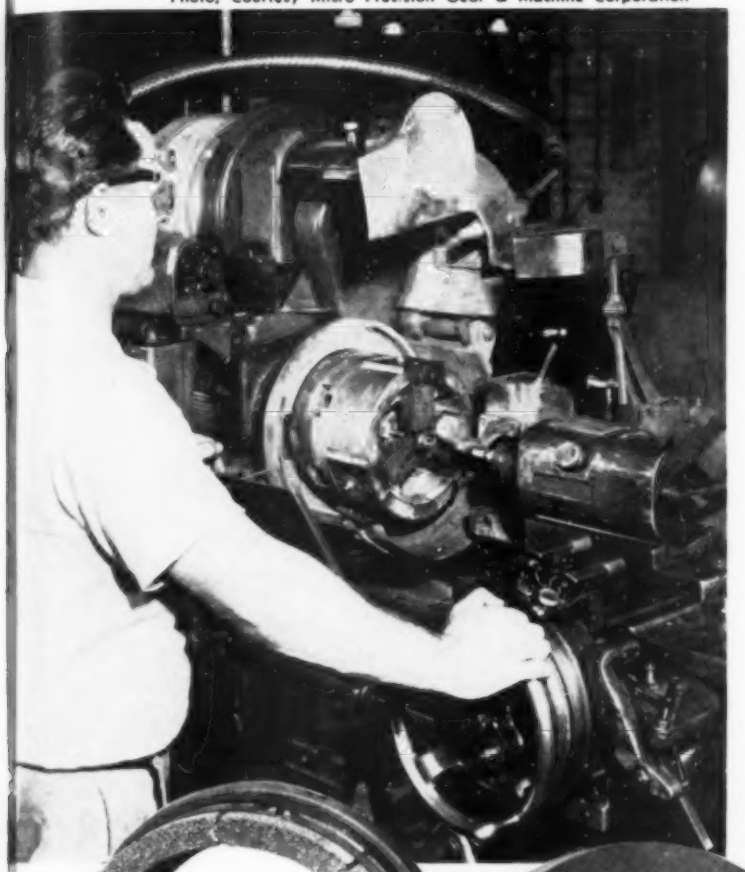
BARNES DRILL CO.

886 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

Use postpaid card. Circle No. 270

Sterling's "sixth element" grinding wheels offer new standards of job-tailored quality

Photo, Courtesy Micro Precision Gear & Machine Corporation



SOMETHING NEW has been added to the standard grinding wheel elements—grain, size, grade, structure and bond. In making its specifications, Sterling considers a *sixth element*—the *human* element—to create an abrasive unit closely tailored to the demands of each individual job.

The sixth element concerns the operator, what he likes in a grinding wheel, what he expects it to accomplish, his work habits, his unusual preferences, and all the many other personal factors that come into being when he works at his machine.

It is this close attention to the *sixth element* that gets more production out of the wheel, sets new standards of economy, and reduces job-fatigue. Creating specifications that are slanted to the operator's likes and dislikes is a special ability that Sterling abrasive engineers will gladly apply to your grinding problem. Write us or your nearest Sterling distributor.

Sterling's small internal grinding wheels carry with them the same assurance of economical performance and quality as the largest "Wheel of Industry." Use them with confidence in superior results.

STERLING GRINDING WHEEL CO. TIFFIN OHIO
USE SAFETY GUARD · SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.
USE SAFETY GUARD · SEE A.S.A. SAFETY CODE
STERLING GRINDING WHEEL CO.

"Wheels of Industry"—Vitrified and Resinoid—provide the most economical and efficient method of metal removal.

STERLING GRINDING WHEELS

"THE WHEELS OF INDUSTRY" STERLING

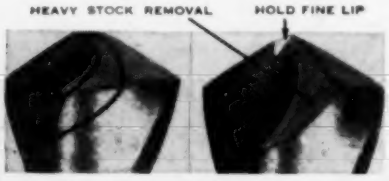
STERLING GRINDING WHEEL CO., TIFFIN, OHIO—SUBSIDIARY OF ABRASIVE AND METAL PRODUCTS COMPANY

Use postpaid card. Circle No. 312

A GRINDING PROGRESS REPORT

Bay State Engineer Finds Way to Triple Production on Chisel Point Grinder

The special "chisel point" on a twist drill makes it start faster in hard materials. Grinding it in one cut and at production rates presents a difficult wheel selection problem, as shown.



For one manufacturer, neither wheels soft enough for the heavy cut nor those hard enough for the fine cutting of the lip could meet the production and quality standards. Expensive overtime shifts were being worked when Bay State was called in.

Bay State District Manager Bob Belmont saw, in this one operation, two grinding tasks so different that one set of wheel "specs" could not possibly do them both.

The "sandwich" wheel illustrated below, with two layers of different abrasives, was his answer. The hard (P grade), fine (220 grit) layer grinds the fine lip. The coarser (150 grit), softer (N grade) side does the heavy cutting.

Bob Belmont demonstrated capable engineering in action. He tripled production, reduced rejects, eliminated overtime, and lowered grinding costs.

To get such effective engineering aid, contact any distributor or office of the Bay State Abrasive Products Company, Westboro, Massachusetts.

Branch Offices are located in Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.; with distributors in all principal cities.

In Canada: Bay State Abrasive Products Co.; (Canada) Ltd., Brantford, Ont.

BAY STATE
WHEELS of PROGRESS

Use postpaid card. Circle No. 313